Electrical World

The consolidation of ELECTRICAL WORLD and ENGINEER AND AMERICAN ELECTRICIAN.

VOL. LVI. NEW YORK, THURSDAY, NOVEMBER 17, 1910. No. 20.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

239 WEST THIRTY-NINTH STREET, NEW YORK.

JAMES H. McGRAW, President.
HUGH M. WILSON, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
CURTIS E. WHITTLESEY, Secretary and Treasurer.
TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITOR.....W. D. WEAVER
A. S. M'ALLISTER.....Associate Editor
W. H. ONKEN, JR.....Associate Editor
W. E. KEILY.....Associate Editor
O. H. CALDWELL.....Assistant Editor
W. M. FINLEY.....News Editor
S. S. BOIES.....News Editor
FREDERIC NICHOLAS.....Special Contributor
J. R. CRAVATH.....Special Contributor

CHICAGO OFFICE.....1570 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
EUROPEAN OFFICE....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico, $3.00 per year; Canada, $4.50 per year. All Other Countries, $6.00 per year. Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. Date on wrapper indicates the month at the end of which subscription expires.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday of the week of issue.

Copyright, 1910, by McGRAW PUBLISHING COMPANY.

Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1909 was 945,850. Of this issue 17,250 copies are printed.

NEW YORK, THURSDAY, NOVEMBER 17, 1910.

CONTENTS.

Editorial 1159
Electrification of Boston Railroads 1162
Revision of National Code 1162
Ohio Telephone Situation 1162
The Electrical Jobbers' Convention 1162
Ilgner Patent on Motor Flywheel Device Declared Invalid 1162
Sectional Trolley-Wire Patent Sustained 1163
Recent Hydroelectric Developments in the West 1163
Commutating Poles in Synchronous Converters 1164
Permanent Exhibition of Safety 1165
New York Commission News 1166
Massachusetts Commission News 1166
Wisconsin Commission News 1166
Maryland Commission News 1167
New Jersey Commission News 1168
American Electrical Engineers.—XIX. W. C. L. Eglin 1168
Current News and Notes 1169
Electric Generating and Distributing System in Reading 1171
Limiting Voltages on Transmission Lines. By Ehrich Hausmann 1179
Effects of the Form of Electromotive Force Waves Upon the Life and Efficiency of Incandescent Lamps 1179
Data on an Electrical Resistance Furnace. By Albert A. Somerville, Ph.D. 1181
Impregnated Telegraph Poles 1183
New Central-Station Office Building for Springfield, Mass 1183
Improved Meter Reading by Prizes and Penalties 1183
Flaming-Arc Lamps in Pueblo's Business District 1183
Central-Station Advertising by Wall Signs 1184
Daylight and Dark-Day Charts at Milwaukee 1184
The Des Moines Plan of Meter Reading 1184
Notifying a Customer When His Bill Is Ready 1185
Electric Shows in Small Cities 1185
Inexpensive Tungsten Standards for Fort Atkinson, Wis 1186
Premiums for Contractors Who Wire Old Houses 1186
Some Tests on Splices in Galvanized-Iron Wire. By C. T. Rashman 1187
Recent Telephone Patents 1188
LETTER TO THE EDITOR:
The Light of the Firefly. By F. Alex. McDermott 1189
Digest of Current Electrical Literature 1189
Book Reviews 1194
New Apparatus and Appliances 1195
Industrial and Commercial News 1198
General News 1202
Weekly Record of Electrical Patents 1210

VOLTAGE WAVE DISTORTION AND THE LIFE OF INCANDESCENT LAMPS.

In a series of tests made by Prof. Charles L. Kinsloe upon various types of incandescent lamps subjected to sine-wave and peaked-wave e.m.fs., an account of which appears elsewhere, results were obtained that can truly be characterized as unexpected. It was found that carbon, tantalum and tungsten lamps suffered a marked decrease in life and efficiency when the e.m.f. wave was peaked rather than sinusoidal. The decrease in life varied from 25 per cent to 50 per cent when the e.m.f. wave reached a peak value 12 per cent higher than the maximum of the equivalent effective sine wave. An analysis of the tests shows that there was only a relatively unimportant change in the watts consumed by the lamps when subjected to either the sine wave or the peaked wave; there was, however, a considerable change with time in the candle-power—and hence in the watts per candle—of each lamp, the change being accelerated when the peaked e.m.f. wave was used. Few persons, indeed, would have predicted such a result in view of the fact that it is usually believed that the candle-power, specific consumption and life of incandescent lamps vary with the "mean effective" value of the e.m.f. wave quite independently of the maximum value. The tantalum lamp exhibits what might be considered an exception to this rule in that its life is known to be shorter with alternating current than with direct current; but the change in life has usually been attributed to the cyclic change in the value of the current rather than to the higher maximum reached with alternating current as compared with direct current.

When subjected to a unidirectional e.m.f. the filament of an incandescent lamp reaches a certain temperature, the value of which can be judged roughly by the lumens emitted per watt consumed by the filament. The life of the filament depends largely upon the temperature to which it is subjected. A slight change in the voltage upon which the temperature depends makes a relatively large change in the life of the filament; for example, 0.5 per cent decrease or increase in the rated e.m.f. impressed on a carbon filament increases or decreases the normal life by about 10 per cent. In the case of an alternating e.m.f. the mean temperature of the filament will vary largely with the mean effective heating value of the current, but there will be a cyclic fluctuation in the temperature, the range of temperature change depending upon the wave shape of the e.m.f. and the heat-storage capacity of the filament. Even with a sinusoidal e.m.f. and a filament of large diameter—that is, of high heat-storage capacity compared with the radiating surface—there will be an appreciable cyclic fluctuation in the temperature above and below the mean value. To the extent that the increase in disintegration of the filament during the period of excess temperature is greater than the decrease in disintegration during the period of lowered temperature the life of the filament will be less with alternating current than

with direct current of the same effective heating value, the loss in life being greater for a peaked wave than for a sine wave.

To what extent the temperature does vary cyclically in a lamp filament is difficult to determine, but if one were permitted to assume a fluctuation above normal corresponding to an increase of 3.5 per cent in the e.m.f. continuously during one half-cycle and below normal corresponding to 3.5 per cent during the other half-cycle, the resultant disintegration would be increased by 25 per cent, or the life would be shortened by 20 per cent, with relatively small changes in the other quantities involved. In view of the fact that the plus and minus changes in disintegration increase greatly with increase in temperature range it would seem that the life of a lamp filament should be less when subjected to a peaked wave rather than a sine wave. Moreover, the disintegration is probably accelerated at the weak spots in the filament by reason of the slowness in conduction of heat from the restricted location where it is produced to the exposed areas from which it may be radiated. The acceleration in disintegration from this cause would probably be greater with a peaked wave than with a sine wave.

It would seem from the above-discussed relations that the decrease in life when a lamp is subjected to a peaked rather than a sinusoidal e.m.f. wave can be explained, in part at least, upon the basis of phenomena upon which the life of lamps have long been known to depend. On the other hand, it is not improbable that other relations not so well known have a bearing upon the life as affected by the peaked wave e.m.f. However, it is difficult to conceive of any effects attributable to the substitution of a peaked for a sinusoidal e.m.f. wave that would not be found when either an alternating was substituted for a unidirectional e.m.f. of the same effective value or a high-frequency e.m.f. was substituted for an equal low-frequency one. The paper by Prof. Kinsloe is of much value in calling attention to the dependence of the life of incandescent lamps upon the voltage wave-shape, and incidentally in showing the difference between rated and actual average incandescent-lamp efficiency. It is to be hoped that his future investigations will cover tests of the comparative life of lamps when subjected to unidirectional and sinusoidal alternating e.m.fs. of equal effective values and also to equal sinusoidal e.m.fs. of low and high frequencies.

THE CHEMISTRY OF THE FIREFLY.

Those of our readers who have been following the discussion of the light of the firefly in our columns recently will read with particular interest Prof. McDermott's letter regarding the chemical side of the phenomenon. The evidence which is adduced goes to show very plainly that the general hypothesis regarding the character of the action by which the firefly and similar creatures produce light is substantially correct—that is, that the light is really a product of slow oxidation of a substance produced by the creature. The structure of the light-producing region with its intricate system of air passages bears evidence that such is the case, and the experiments on the tissue which carries the light-producing substance leave no doubt in the matter. The fact that the luminous tissue, when dried and kept out of contact with oxygen, long retains its power of glowing when subjected to purely chemical oxidation is sufficient evidence of the fundamentally chemical rather than physiological nature of the light production, with which the living organism would appear to be connected only as it produces the material upon which in the presence of moisture oxygen can act. The supply of the material is a physiological function and its utilization apparently a chemical one.

The clearing up of this one matter lends a new interest to the subject of firefly light, particularly in view of the work of Trautz which Prof. McDermott quotes. This investigator obtained light giving a spectrum analogous to that of the firefly from the oxidation of pyrogallol in the presence of formaldehyde. Now, this reaction, while complicated in the sense in which many reactions of organic chemistry are complicated, is still probably simple compared with the oxidation of any of the fats or albuminous material likely to be present in the firefly. The substances concerned are of well-known structure and free from any forbidding complications. If they are genuinely capable of producing substantially the same spectral distribution of energy as in the case of the firefly's light, an important step has been taken toward the practical production of chemical luminescence. It would be worth while for somebody to investigate this reaction thoroughly with a view to determining the real limits of the spectrum in the light produced.

If it should be found that this light is really unaccompanied by any material amount of other radiations, the situation will become still more interesting. For it will then appear that there is a theoretical available method of producing a continuous spectrum over a very narrow range, a thing which is quite outside of previous experience. Of course, it might turn out that in the case of the firefly the radiations of longer wave length are utilized in doing physiological work in the organism to an extent which would practically suppress them as regards external effects. In this case the total efficiency of the operation might be really very moderate. It is therefore doubly important to examine the cases of luminescence which occur without the complication of having their seat in organic tissues. Of course, the practical difficulty at once occurs to one that all the luminescence phenomena thus far known are relatively of very low intensity, so that they might prove to be utilizable only with great difficulty even if they could be readily produced. All this, however, remains to be seen. It is at least certain that from the chemical standpoint the firefly's secret does not belong in the region of the physiological unknowable, and that there is a fighting chance of its being discovered and put to some practical use.

DATA ON AN ELECTRICAL RESISTANCE FURNACE.

In electric furnaces a distinct advantage of the resistance type of furnace over the arc type is that for laboratory investigations the distribution of resistance may readily be made such that the distribution of heat generated can be controlled or altered in design. By distributing the resistance in a suitable manner the distribution of heat liberation may be such as to keep a uniform temperature within a certain area, or a uniform temperature gradient over a certain distance. In the arc furnace a similar degree of temperature control is probably unattainable, although for industrial purposes it may not be required. In an article on page 1181 Dr. Albert A. Somerville gives

the details of a laboratory resistance furnace with which certain definitely stated results are obtainable. As these details are readily capable of being reduplicated, they should be useful to those who wish to reach and control similar high temperatures in a small space.

HIGHER EDUCATION.

In the days of ancient Greece, and also in the Middle Ages, the persons who attended universities were, with few exceptions, zealous scholars and thirsters after knowledge. It is true that rich men occasionally sent their sons to a university in order to gain some acquaintance with the teachers and the knowledge of the time, but these dilettantists formed so small a minority of those in attendance that they did not appreciably modify the codes of thought and action of the main body. To be a scholar was in the dark ages tantamount to being greatly in need. With the progress of civilization in general, and of applied science in particular, these ancient and medieval conditions and notions changed, until it became not only advantageous for men of ability to develop that ability at college, but it also became socially recognized as a rank mark. A university degree became the only title to permanent social rank that a democracy would countenance and bestow. The result has been that most men who can afford to do so send their sons to college, especially in this country. The aggregate student enrolment in the colleges of the United States during the last century has increased much faster than the population, notwithstanding the fact that less than 1 per cent of all who enter the primary schools pass on to college. The increased popularity of the colleges has probably been productive of much good on the whole, but incidentally it has lowered the average of scholarship in the colleges. Whereas formerly none would go to college who were not studious, now perhaps more go for general social advantages than for study. Consequently, the studious few are exposed to the banter of the many, and those who might become good mental workers, but are ambitious of social recognition, conceal and minimize their studies in deference to the average judgment.

But this is not all. This country is at present committed to the policy and veneration of personal individual selection to such an extreme that discipline is frowned down, in common with all that tends to nominal restriction of individual freedom. In the average home, and in the average school, the discipline is of the least rigid character. The student must be inveigled into applying his mind, and never coerced. This is a wonderful national tribute to the ideal of liberty, but the cost of this ideal must be paid. In spite of the fact that the average American boy is mentally probably more active and alert than the average German boy, the latter at seventeen years of age is generally admitted to be two years ahead of the former in his studies. Consequently, the first two years of American college intellectual life are of German infra-college grade, although the teaching is carried on by men of university rank. Since the colleges have by increased enrolments extended their influence deeper, and to greater utility, into the mass of the people of modern time, they have been compelled to lower their own standards in order to meet the conditions. Earnest and fruitful intellectual work has largely been driven out of the American college into the graduate school. No person ordinarily enters a graduate school in any American university except for study, and no person is ordinarily admitted there except such as have indicated their capacity to study. Therefore, the ideals and purposes that formerly invested the college have trekked across the A.B. degree and have intrenched themselves within the graduate schools of the country. It is mainly in these graduate departments that research and study are conducted. To them is confided the intellectual wealth of the country. From them issue the best students, workers, ideas, ideals and results that American universities can foster.

President Schurman, of Cornell University, in his annual report just out makes a strong plea for the graduate school, and refers incidentally to the present degradation of undergraduate education—to the great weakness in permitting "men who have no intellectual tastes or interests, provided they can find a sufficient number of easy courses or easy-going teachers, to spend four years without much immediate profit to their minds, and with ultimate serious damage to their characters, in consequence of the formation of habits of idleness, listlessness, and perhaps deception, sham and 'grafting'." President Schurman believes that the future of the American university is with the graduate school or department of research. It is, he said, by the enlargement of human knowledge that progress, civilization and improvements in the life and conditions of mankind are rendered possible. The scientist with his useful experiments and the scholar with his productive researches are the seers and accredited leaders of mankind in this twentieth century. These and other considerations are presented in support of a plea for large endowments for research, the need of which endowments gives the multi-millionaire, he believes, the best opportunity that exists to-day in America for an investment to promote the higher intellectual life and civilization of the nation. The advantage of universal higher education may, he says, be retained for all who are qualified to enjoy it, without sacrificing those youth of superior or extraordinary endowments, among whom will always be found the men who advance civilization and move the world forward in the course of progress. "These glorious 'sports of nature' have in their unique endowments the possibility of higher things for civilization, provided only that it is developed by favorable environments. A seminary for the aristocracy of talent would be the highest and noblest institution in the world. No other service to the democracy could compare with this, for to form the mind and character of one man of marked talent, not to say genius, would be worth more to the community which he would serve than the routine training of hundreds of undergraduates." Let, he says, the superior student be regarded as a supreme object; let the men of talent be segregated and instructed by themselves; for what, he asks, is better worth while in the world than provision for the instruction of the world's best minds and the moderate satisfaction of the bodily needs, that they may pursue their studies not only undisturbed, but under the most favorable and stimulating conditions? In these days of "department-store" college organization and the subordination of the true interests of education to the exigences of padded student rolls, the views of President Schurman are both refreshing and a rebuke to the commercial spirit which has little or no interest in intellectual development aside from its incidental effect in strengthening the specific money-making faculties.

Electrification of Boston Railroads.

In a report prepared in compliance with a resolution of the Legislature of the State of Massachusetts, which provides for a study by the railroad corporations with reference to the "electrification of their passenger service" within the Boston district, Mr. E. H. McHenry, as vice-president of the New York, New Haven & Hartford Railroad Company, showed that there would be required for this service an equivalent of 461 miles of single-track equipment, the total cost of which would be $32,751,000, including generating station, locomotives, etc. He claimed that the operation of a mixed steam and electric service near New York has proved very unsatisfactory and expressed the conviction that no general substitution of electric for steam traction should be made unless the substitution be complete, including passenger and freight operation and yard switching. He stated that in making such a substitution the operation should be extended to include the full length of run, or engine district, in order to avoid the uneconomical subdivision of the present "train runs." The estimates given have been based on types of overhead structures and suspended system similar to those installed on the New York division of the New Haven road, subject to certain modifications and improvements which experience has indicated should be made.

In a report submitted by Mr. A. H. Smith as vice-president and general manager of the Boston & Albany Railroad it was stated that the track length involved would total 128 miles, and the net cost would be $6,413,300. The estimates have been based on a direct-current third-rail system similar to that now employed by the New York Central & Hudson River Railroad Company, but using 1200 volts instead of 600 volts. The opinion was expressed that in case the railroad is required to equip its trains for electrical operation it should be permitted to increase its fares to cover the loss in revenue involved in the expense of electrification.

Revision of National Electrical Code.

The biennial meeting of the electrical committee of the Underwriters' National Electric Association will be held in March, 1911, in New York City, the day and place of the meeting to be announced later. As usual, the provisions of the National Electrical Code as they now exist will be the principal matter for consideration. Suggestions for any desired change in, or addition to, the code should be forwarded to Mr. C. M. Goddard, secretary, 141 Milk Street, Boston, on or before Jan. 15, 1911, in order that they may be printed in the bulletin and thus enable the committee and other interested parties to consider the subjects in advance of the meeting. Final action on suggestions not received in season for consideration by the committee before the meeting can only be taken up by unanimous consent. As heretofore, the meeting will be open to all interested, who will not only be welcome, but are urged to be present and give the committee the advantage of their experience and advice.

Ohio Telephone Situation.

The consolidation of rival local telephone exchanges in the various small towns and cities in Ohio is being gradually worked out successfully, as well as dual connections of the long-distance systems with the consolidated exchanges. Early in the month the Tiffin Consolidated Telephone Company took over both the independent and Bell exchanges at Tiffin and merged the two plants into one. Then connections were made with both the United States Telephone Company and the American Telephone & Telegraph Company.

About the same time the Greenfield Home Telephone Company, which had operated in the past as an independent, took over the Central Union Exchange at Greenfield and connections with the lines of both the long-distance companies were made. The toll-line subscribers of both the old companies may use either long-distance line desired, as all such lines are now connected with the one exchange in the town.

The independent and Bell exchanges at Hudson, Medina, Geneva, Savannah, Higginsport, Mowrystown and Bufort have been consolidated within the past few months. In all these cases the Central Union Telephone Company has practically turned over the local business to the home companies in exchange for the long-distance connections for the Bell company.

The Electrical Jobbers' Convention.

The convention of the Electrical Jobbers' Association was held at Hot Springs, Va., Nov. 9, 10 and 11, and was attended by about three hundred electrical supply men and manufacturers. The meetings of this association are mostly social in their character and are intended to promote good fellowship and mutual understanding among the men engaged in the electrical supply trade of the United States.

Several papers of interest to the trade were read and discussed. Aside from the business meetings much time was given to social features. Among the latter was a golf tournament, the prize winners of which were Col. H. V. Carter, Messrs. R. B. Corey, F. Oblinger, M. B. Austin and Al. Palmer. The tennis tournament was won by Messrs. H. I. Sackett and H. M. Betts; clay-pigeon shooting was won by Mr. W. C. Hopkins, and pool and billiards by Messrs. J. A. Vaughan and F. E. Stowe.

During the meeting a pleasing tribute was paid to Mr. W. W. Low, of the Electric Appliance Company, Chicago, in the shape of a song written by Mr. W. H. Sheldon, Jr., and sung by the gathering to the tune of "America." Mr. Low was completely taken by surprise, but he managed to make suitable and appreciative response. Mr. Low has probably done more than any other individual to foster and develop the association. Another pleasant affair was the presentation of a handsome silver mesh bag to Mrs. Searing, wife of Col. George S. Searing, of Chicago, as a mark of respect and of the esteem in which "Uncle George" is held by the entire association.

The next meeting will be held in February, 1911, in the Middle West, at which time plans will be discussed for the Pacific Coast convention, which will be held in May or June of next year. It is probable that some date in June will be selected in order not to conflict with the date of the National Electric Light convention.

Ilgner Patent on Motor Flywheel Device Declared Invalid.

The British court of final appeal on Oct. 20 sustained the decision of the lower court, as reported in our columns April 21, 1910, declaring invalid the Ilgner patent covering the addition of a flywheel to the Ward Leonard motor system. As pointed out in a letter from a correspondent printed in an issue following the decision of the lower court, the procedure in this important patent litigation is very interesting when compared with that of similar litigation in this country. Several of the most important electrical manufacturing concerns in Europe were involved in the litigation, and among the experts in the case were professional leaders such as Swinburne, Parshall, Mordey, Ferranti and Hopkinson. The hearing was in open court, and the judge frequently cross-examined the experts. The entire case from start to finish in the lower court occupied six days. The hearing on appeal lasted about an hour, and the court, composed of three judges, handed down a decision at once. It is said that the entire cost of the litigation to the defendants, including expert service, was less than $15,000.

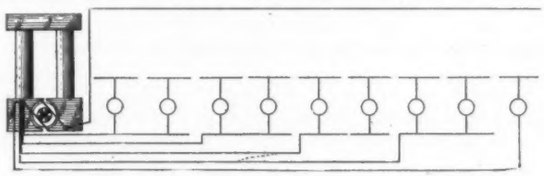
The patent involved was one issued to Ilgner relating to electrically driven reversible rolling mills. In the judgment, which was orally delivered, Lord Justice Moulton said that the court had been impressed with the fact that a plant with a normal output of 3000 hp can at critical moments supply 15,000 hp, and the means whereby this may be accomplished is decidedly an electrical engineering triumph. The court held that the Ward Leonard patent of 1891 anticipated that of Ilgner, and that the Ward Leonard invention had not remained unknown to others than those whose business it is to search the

records of the Patent Office, but was a part of the common stock of knowledge of electrical engineers at the date of the grant of the Ilgner patent. Referring to a Ferranti patent of 1895, the court said that it did not have to decide to-day whether Mr. Ferranti's suggestion of the addition of a flywheel to the Ward Leonard invention was or was not an invention, but its personal view was that the idea of doing so was perfectly obvious to any skilled electrical engineer, and that there was in fact no invention at all in Mr. Ferranti's suggestion. The decision was that the arrangement covered by the Ilgner patent was not the subject of invention.

Sectional Trolley-Wire Patent Sustained.

The full text has just come to hand of the opinion, rendered June 17, of Judge Bradford, of the United States Circuit Court for the Eastern District of Pennsylvania, sustaining broadly a patent granted Sept. 10, 1895, to William M. Schlesinger, covering the use of a sectional trolley wire in connection with safety cut-outs.

The patent, for which application was filed Nov. 24, 1885, contains three claims, the first of which is as follows: "In an electric railway the combination of a series of separate feeding conductors extending in multiple arc relation from one generator pole or terminal to points along the line of way, safety devices for said separate feeding conductors, a working conductor comprising a series of insulated or disconnected sections disposed along the line of way and supplied by said separate feeding conductors, and a return circuit connection opposed to said sections and leading to the other generator pole or terminal." The other two claims relate specifically to an automatic



Schlesinger Sectional Trolley-Wire and Protective System.

electromagnetic device for disconnecting a section of the trolley wire from the feeder in case the current should exceed a certain predetermined value. Only the first claim above quoted was involved in the suit. In the accompanying illustration the sectional trolley wire, the safety devices and the feeders are clearly indicated. The suit for infringement of the Schlesinger patent was brought by the Allis-Chalmers Company against the General Electric Company as manufacturer, and the Hestonville, Mantua & Fairmount Passenger Railway Company as user, of the alleged infringing railway equipment.

The defenses set up were respectively that the prior art negatives invention on the part of Schlesinger at or before the date of the application; that if the claim in suit be valid it must receive a construction so limiting its scope as to negative infringement by the defense; that the invention, if any, was abandoned; that the invention disclosed in the application is substantially different from the combination claimed, and that the rights of third persons respecting patents for inventions made after the date of Schlesinger's application and before the date of the patent suit cannot be affected by the granting of that patent.

The court in considering the defense that the invention disclosed in the application is substantially different from the combination claimed stated that, while it is true that the combination of the claim does not appear in any of the claims in the application as originally filed by Schlesinger, this fact is not of itself determinative of the question whether that combination was not disclosed in the application and its accompanying drawings when considered as a whole. The fact that the original specification was too broad, through including "any translating media," affords no reason why the claims and descriptions should not be restricted, as they have been, to an application of the system to electric railways. The conclusion of the court reached on this consideration is that the invention embodied in the combination of the claim in suit and illustrated in one of the figures (which is reproduced herewith) is substantially the same as that for which application for patenting was originally filed. As to anticipation, the court says that little need be said, as the defence which was set up on this point appears to have been abandoned, and the record does not disclose, so far as the court could find, any anticipation, by patent or other matter, of the combination claimed. While it is undoubtedly true that each of the elements composing the combination was old, the claim presents a true combination and not a mere aggregation.

Taking up the defense that the combination had been abandoned to the public, the court stated that while the file wrapper and contents showed that from October, 1887, to November, 1894, there were no proceedings in the Patent Office in the prosecution of the application, this delay was shown to the satisfaction of the Commissioner of Patents to be unavoidable, owing to the patent attorney of the inventor having become incompetent through a gradual mental ailment that ended in insanity. The record does not disclose any actual intention to abandon, or any act or declaration of abandonment, or any consent to the appropriation or use by others of the invention, and the court decided that the invention in suit was at no time abandoned.

Concerning the rights of third parties receiving patents for inventions made between 1884 and 1895, the court held that in the interim there was no attempt to enlarge the scope of the patent as originally filed, there was no expansion of claims nor anything done by the inventor or those representing him to deceive or mislead the public.

The court then considered in detail the question of actual infringement and held that Schlesinger had a right under his patent to place his safety device in any separate feeding conductor electrically connected with any section of the working conductor in such separate feeding conductor, either at or near the generator or at any other point between the generator and the branch conductor, and that the right could not be lost or affected by the fact that in placing it at or near the generator or central station it would serve as an electrical indicator. He was entitled to any additional use or benefit to be derived from such change in the location of the safety device, and the fact that in the defendant's arrangement the safety devices served as such indicators is wholly immaterial to the question of infringement if their location at or near the generator does not destroy their function as safety devices.

The court concludes that the combination of the defendant's arrangements or system infringes the claim of the patent in suit, since it includes all the elements of the patented combination, co-acting and inter-acting upon the same principle, performing the same function in the same manner and presenting substantially the same results.

Recent Hydroelectric Developments in the West.

Mr. James Lyman, district engineer of the General Electric Company, read a paper on "Recent Hydroelectric Developments in the West," at the meeting of the Electric Club of Chicago, on Nov. 9. Mr. Lyman has lately returned from a Western trip, and his paper contained some of the results of his observations.

Mr. Lyman said that the first step in the conservation of national resources should be the efficient development of the great water-powers of the country. Unlike the forests and the deposits of coal and other minerals, the water-powers are never-ending, with proper protection of the forests. So far practically all the water-power developed in this country has been by private enterprise. Some of the larger plants involved the expenditure of millions of dollars, and these developments can be carried out only by large financial interests.

The laws governing the rights for hydroelectric development are inadequate and indefinite, and the subject should receive the immediate and careful attention of Congress. "There may

be reason," said the speaker, "in the contention that the water-power rights of our country should not be granted forever to private corporations, but the private corporation which is willing to promote them becomes a public benefactor, like the inventor who introduces some great economy. Like the inventor, in my opinion, the corporation should, for a limited time, say forty or fifty years, reap all the profits of the development. Later, such adjustment in power rates, or such division of profits with the government, should be made as will surely safeguard the large capital investments by the corporation."

Mr. Lyman sketched briefly several interesting developments, mentioning first the system of the Central Colorado Power Company. Here, he said, the 100,000-volt transmission line carried over the Leadville Divide at an elevation of 10,000 ft. across very rough country is perhaps the most difficult piece of transmission work ever undertaken. Some of the cable spans are more than 2000 ft. long. At the Boulder plant of this company a little stream is piped down an almost precipitous mountainside, 1800 ft. in height, to two 5000-kw impulse wheels, and passes out into the atmosphere as "white foam and a rainbow."

In California water-power developments of more than 500,000 hp are in service out of an estimated possible total of 9,000,000 hp. As a rule, the water-power stations feeding over long high-tension transmission lines are operated under nearly constant load, while the stations located nearer the center of distribution take the load fluctuations and control the frequency. The voltage of the distribution system is controlled by Tirrill regulators connected to the excitation circuits of synchronous motor-generator sets or rotary condensers.

The Pacific Gas & Electric Company of San Francisco has developed the largest distribution system in the world. With more than 1000 miles of three-phase 60,000-volt transmission lines, it supplies nearly 100,000 kw in electrical energy to 153 cities and towns in an area about 200 miles north and south and 100 miles east and west, containing one-half the population of California. Energy is supplied from eleven water-power generating stations and three steam-generating stations, some of them more than 200 miles apart. All of these stations are controlled by a single power dispatcher, who has become so expert that trouble occurring at any point can generally be located and the section cut out in three or four minutes, usually without cutting off any of the generating stations or disturbing the voltage regulation of the system for more than a few minutes. The average daily load factor is 75 per cent, which is high for such mixed motor and lamp circuits.

The largest electrical supply of this company comes from the Feather River station of the Great Western Power Company, 154 miles northeast of Oakland. This plant is remarkable, according to Mr. Lyman, in having the largest and most efficient water turbines, water-wheel driven generators and step-up transformers ever built. Here the generating units are rated at 10,000 kw and are capable of as high as 50 per cent overload. Further, the water head of 430 ft. is the highest under which turbine wheels have ever run.

The Stanislaus water-power development, 130 miles east of San Francisco, operating over 104,000-volt lines into that city and supplying the street railway system with a large part of its energy, is one of the most expensive and difficult water-power developments in the West, costing, all told, more than $12,000,000. The power house is situated in the deep canyon of the Stanislaus River, a sheer 1500 ft. below the rim of the canyon.

The speaker next considered the group of hydroelectric plants in the Los Angeles region. A large portion of the energy from the Kern River development is supplied to the Pacific Electric Railway Company, one of the largest and best-managed interurban systems in the country. Mr. Lyman described briefly the Owens River aqueduct, which will be 230 miles long and deliver 260,000,000 gal. of pure mountain water daily to the City of Los Angeles. This aqueduct will have water-power development possibilities to the extent of 120,000 hp. Mr. William Mulholland, the chief engineer, believes that the income from the energy developed will pay for the aqueduct in twenty years. Five thousand men are now employed in the construction of this great work. Electric dredges and electrically operated shovels make all excavations. A 3000-kw power plant supplies the energy. Only by the use of electric energy, the telephone and the automobile is it possible to construct this 230 miles of aqueduct across a broiling desert. Its value to Los Angeles and the whole San Gabriel Valley, when completed, will be incalculable.

Mr. Lyman spoke of the Little Falls plant of the Washington Water Power Company, near Spokane, as one of the best hydroelectric developments he had ever seen. Another company, the Great Falls Power Company, transmits energy at 100,000 volts for 150 miles from Rainbow Falls to Butte, Mont. It is proposed to abolish the large steam plants at the thirteen copper mines in Butte, and operate the hoists by compressed air furnished by electrically driven air compressors. These mining plants now use 25,000 hp in steam hoists.

At least five large power-transmission plants are successfully delivering electricity from 50 to 150 miles at from 100,000 to 110,000 volts. Above 110,000 volts air begins to lose its perfect insulating qualities and a slight leakage takes place. However, a 135,000-volt line is under construction, and there is little doubt that means will be found to make the use of this voltage or even higher voltages feasible. So far as the transformers, oil switches and line insulators are concerned, they can all be built for much higher voltages; the insulation of the air alone is apparently all that limits the line potential.

There was a brief discussion, those taking part being Messrs. D. W. Roper, F. A. Sager, C. Gilbert Wheeler, A. A. Gray and W. M. Bennett.

Commutating Poles in Synchronous Converters.

In a paper by Messrs. B. G. Lamme and F. D. Newbury presented at a meeting of the American Institute of Electrical Engineers on Nov. 11 there was given a remarkably clear presentation of the m.m.f. flux, e.m.f. and sparking relations in direct-current generators and synchronous converters. The authors described the production of flux locally at the coil undergoing commutation by the local current in the armature and explained the generation of a detrimental e.m.f. in the coil by reason of this flux and because of the local reactance of the coil for the current reversing therein. Commutating poles provide a local m.m.f. to more than counterbalance the armature m.m.f. and hence to produce in the coil under commutation an e.m.f. tending to counterbalance the reactive e.m.f. in the coil and thereby eliminate the causes for sparking. On account of the fact that the m.m.f. of the current on the input side of the synchronous converter is in space opposition to that on the output side, the resultant armature m.m.f. of a converter is much less than that of a direct-current generator of equal output and the commutation conditions are much more favorable; the conditions, in fact, are at least as good as in a direct-current generator with a compensating winding of normal design located in the pole-faces only. In a synchronous converter the uncompensated armature m.m.f. varies between 7 per cent and 20 per cent of the m.m.f. of an equivalent direct-current generator armature. Thus one of the principal sources of difficulty in commutation of the direct-current generator is largely eliminated in the converter, so that commutating poles that may often be a necessity with the former machine are seldom needed with the latter machine.

The authors discussed the commutation conditions in 25-cycle and 60-cycle converters designed for 250 volts and 600 volts and said that 25-cycle, 600-volt converters offer the most promising field for the application of commutating poles; that 60-cycle, 600-volt converters follow next, and that 60-cycle and 25-cycle, 250-volt converters show the least possibilities of improvement from the standpoint of design.

The advantages of commutating poles are that less attention is required during operation and that the life of commutator and

brushes is longer, with a possible reduction of cost in case higher speeds are employed. The disadvantages are: Possibility of increased trouble from bucking on sudden changes in load or short-circuits; possible reduction in efficiencies, particularly in light load, and higher operating temperatures unless the same temperatures as now obtained in non-commutating pole machines are maintained by partly sacrificing the advantage of lower cost.

The authors expressed the belief that from the standpoint of design it seems difficult to make a sufficiently strong case for the commutating pole in synchronous converters to warrant the additional complication in construction. At best the addition of commutating poles, properly applied, represents a refinement over present designs, and the basic question is whether such refinement is justified commercially. They said that this question must be decided, as all engineering problems are finally decided, not by the judgment of one man or any group of men, but by the results of experience in extended operation.

Discussion.

The discussion was opened by Mr. Gano Dunn, who called attention particularly to resistance commutation as contrasted with magnetic commutation, which is the basis of the operation of interpoles. He showed that by the use of dead brushes along the commutator adjacent to the live brushes, but insulated therefrom, resistance commutation becomes quite effective and results equal to those obtained with commutating poles may sometimes be secured at much less cost and improved efficiency.

Mr. H. F. T. Urban claimed that the best field for commutating-pole converters is in intermittent railway work, the converters for which are designed on the basis of commutation with overload rather than heating with average load. With such machines commutating poles are economically necessary. They should also be with high-voltage synchronous converters, built for, say, 1200 volts or 1500 volts. He cited the case of a certain 750-kw, 1200-volt synchronous converter which was not damaged by being directly short-circuited a dozen times.

Dr. C. P. Steinmetz remarked that when the limits of design are set by commutation rather than heating the use of commutating poles allows the manufacturer to build smaller and cheaper machines. In interurban railway service, where the load fluctuates rapidly, the heating limits are eliminated and the only limit of overload is commutation. Hence, for interurban railway work commutating-pole synchronous converters are advantageous.

Mr. Jens Bache-Wiig stated that the chief cause for "flashing over" at the commutator is the sudden interruption of the direct current when the circuit-breaker opens under short-circuit conditions. He suggested the use of an electric interlock between the direct-current and the alternating-current circuit-breakers so that when the former opens the latter will open also.

Mr. Paul M. Lincoln said that only in the cases of high speeds or large outputs are commutating poles necessary on synchronous converters and expressed the opinion that when the conditions requiring commutating poles are approached in converters it is impossible under such conditions to use the split-pole converter because the latter takes considerable liberty with the commutating conditions.

Mr. J. L. Burnham described some tests made upon a certain 25 cycle, 1200-volt synchronous converter. The load at which sparking would commence, without commutating poles, was carefully determined. Commutating poles were then fitted to the machine and adjusted so it would carry four times the load to cause the same sparking as without the commutating poles; four times full load could be thrown on and off successfully.

Mr. C. W. Stone expressed the opinion that the principal reason why commutating-pole converters have not been used in interurban railway service, where they could be employed advantageously, is because operating engineers could not be convinced of the advantages to be obtained. The chief advantages in the use of commutating poles on synchronous converters will be the reduction in the size of machines for intermittent service and the building of high-voltage and high-frequency machines.

Mr. Lamme in closing the discussion called attention to the fact that in interurban railway service use is made of small converters with which commutating poles are not necessary, while in high-voltage machines the real limit is not the commutation, but the mechanical difficulties encountered in building the commutator.

Permanent Exhibition of Safety Devices.

The formal opening of the Permanent Exhibition of Safety Devices of the American Museum of Safety, in its new quarters in the Engineering Societies Building, New York, will occur on Monday, Nov. 21, at 8:15 p. m.. The general public is invited to be present on the occasion. The large space taken by the museum is already well filled with various safety devices supplied by the makers or collected by the director, Dr. W. H. Tolman, in order to educate the public on the "conservation of life." The object of the American Museum of Safety is to show how accidents may be prevented by the use of safety devices in connection with machines, systems of transmission, elevators, cranes, steam boilers, explosives, etc. The investigations of Dr. Tolman have indicated that 50 per cent

Exhibit of Safety Devices.

of the accidents to American life and labor are preventable, and to assist in avoiding this needless waste of life the Safety Museum is made a clearing house for every worthy safety device. Among the indirect advantages of accident prevention, as adduced from the world's practical experience, are the lessening of expensive damage suits for accidents through making machines "safe" as well as "foolproof," and in securing greater efficiency through knowledge on the part of workmen that a machine is safe, which feeling in a sense is a cash asset through enabling him to do better and more work, and thus increase the output. It is pointed out that a more general use of safety devices will be a defense against hasty and ill-considered legislation, compelling the adoption of protective devices without regard to their practicability or cost.

New York Commission News.

The Public Service Commission, Second District, will give a hearing this week on the complaint of the Islip Electric Company against the Sayville Electric Company as to alleged unlawful stringing of wires and furnishing of electricity in East Islip, on the application of the Suffolk Gas & Electric Company for authority to acquire all of the outstanding capital stock of the East Islip Electric Company and to merge the latter company with the Suffolk company.

Massachusetts Commission News.

The final hearing upon Boston transportation matters under consideration by the commission on Metropolitan Improvements was held at the office of the Boston Transit Commission on Nov. 8. Chairman W. P. Hall, of the Massachusetts Railroad Commission, presided. Mayor Fitzgerald, of Boston, appeared on behalf of immediate subway extensions to South Boston and Dorchester. He disagreed with the Boston Chamber of Commerce regarding the necessity of pausing in subway development to plan out a scheme for a long term of years. Mr. Joseph B. Eastman, counsel for the Boston Public Franchise League, argued that public opinion is responsible rather than the local traction company for the extensions to the rapid transit system made during the past few years, and he opposed the granting of an 8 per cent dividend on the stock of the West End Street Railway Company in the event of a formal consolidation of that organization with the Boston Elevated. He presented a letter from President C. L. Edgar, of the Edison Electric Illuminating Company of Boston, in which the latter stated that substantially the same rates have been offered the Boston Elevated by the Edison company as were accepted by the street railways in Chicago, which are now supplied with energy by the Commonwealth Edison Company. Mr. Edgar pointed out that the street railways in Chicago had shut down their own plants in favor of purchased energy, and said he regretted that so far the Boston Elevated Railway Company's officials held to the erroneous view that they can produce electricity more cheaply in their own plants. Mr. Eastman said that it would be possible for the Boston Elevated Railway Company to erect a new power plant with the ultimate needs of the West End system in mind, and later, if the two systems had to be separated, it would be a comparatively simple matter to supply the energy by purchasing from the Edison company. He contended that the peak loads do not occur at the same time on the surface and the elevated lines, and that this would materially aid the Edison company in furnishing low-priced service.

Professor Cooley, of the University of Michigan, appeared on behalf of the protective committee of the stockholders of the West End Street Railway Company, and said that in his opinion a dividend of 8 per cent is entirely reasonable for the West End stockholders. He had found the system in excellent condition, both from the physical and the operating standpoint, and considered that its capitalization is reasonable. He also felt that the Boston Elevated system is worth all that its capital represents. Consolidation would bring about many economies and improvements in service, and would lessen the amount of capital required for the system as a whole. Eight per cent on the par value of the West End stock is only about 5.3 per cent on the market price. Professor Cooley said that 90 per cent of the valuation which he had carried out in the past twelve years had been made from the standpoint of the public, and had involved almost $1,000,000,000. From this experience he was certain that the 8 per cent rate was entirely reasonable. He stated that he was familiar with public utilities paying from 8 per cent to 14 per cent without question on the part of the public.

As a result of a recommendation made last week by the Massachusetts Highway Commission, the New England Telephone & Telegraph Company, through its president, Mr. J. N. Keller, has extended the existing four-party and six-party line suburban service until Nov. 1, 1911. The company states that it welcomes this action as an opportunity for subscribers to study the new schedules of rates laid down at the recommendation of the commission, after an exhaustive study of the plant and traffic by Prof. D. C. Jackson, its consulting engineer. President Keller states that several thousand subscribers to the present four-party and six-party suburban service have already made application to the company for service under the new schedule. In case any of these have applied through the understanding that the change will shortly be made compulsory, the company will transfer them to their former service if they so desire, provided they will indicate their intentions by Nov. 21. The company is making every effort to avoid injury to the service on account of construction and operating difficulties during the inauguration of the new rates.

Wisconsin Commission News.

The Railway Commission has reported upon the investigation that it has made in connection with the electric service in Evansville, Wis. The investigation was the result of a demand for a day electric service and an expressed desire on the part of the municipality that the commission investigate the conditions in Evansville and recommend the rates which should be charged for such service.

The report discusses in some detail the probable results of a day service and suggests several alternatives as to the method of supplying energy for the day service as well as the rates that could be charged for the same. Nothing definite could be offered because of the lack of data concerning the probable motor load.

The present sliding-scale schedule of rates for incandescent lighting was found objectionable because it created discrimination between consumers. It classified residences as small consumers and stores as large consumers, and recognized only the quantity of energy consumed without any regard to the fundamental factors of demand and hours daily use of the connected load. The investigation further disclosed the fact that special rates had been granted to several consumers in Evansville under the condition that these consumers furnish lamps, meters, transformers, etc. This is contrary to the public-utilities law, which reads: "It shall be unlawful for any public utility to demand . . . less compensation for any service rendered . . . in consideration of the furnishing . . . of any part of the facilities incident thereto. . . ."

The rate schedules suggested by the commission are based upon the actual cost of service, properly apportioned between the different departments. By prorating the commercial output expenses over the units of energy consumed, the output cost per kw-hour was found to be 5.575 cents. The capacity expenses per kilowatt of active connected load, on the basis of 50 per cent active, were $25.47, which, with the unit output cost, gives the following table of unit costs:

Capacity.		Output.	Total.		
13.956c	+ 5.575c	= 19.53c	½ hr.		
6.978	+ 5.575	= 12.55	1	"	
3.489	+ 5.575	= 9.06	2	"	Operation daily, active connected load.
1.395	+ 5.575	= 6.97	5	"	
.698	+ 5.575	= 6.27	10	"	

On the basis of the above table several schedules were recommended, as follows:

Ten cents for first sixty hours and 8 cents for excess.

Eleven cents for first sixty hours and 6 cents for excess.

Twelve cents for first sixty hours and 6 cents for excess.

Twelve cents for first thirty hours, 8 cents for next thirty hours and 6 cents for excess.

Eleven cents for first thirty hours, 9 cents for next thirty hours and 6 cents for excess.

With regard to the active connected load, the consumers are divided into three classes, as follows: Class A, residences, pub-

lic buildings, etc., 40 per cent active; Class B, churches, schools and industrial establishments which close not later than 6 p. m., 60 per cent active; Class C, offices, hotels, theaters, depots, restaurants, etc., 75 per cent active. These consumers were apportioned to the several classes after a detailed study of the consumer data as furnished by the consumer ledger.

The receipts from street lighting were found to be so close to the actual expenses of the same as to warrant no change in the rates.

The brief of Mr. Lester C. Manson, special counsel for the City of Milwaukee, in the proceeding pending before the commission in reference to a 3-cent fare has been filed. In its brief the city contends that the Milwaukee Electric Railway & Lighting Company can sell eight tickets instead of six for a quarter and four tickets to Wauwatosa, Whitefish Bay and North Milwaukee for 25 cents instead of 30 cents as now charged. The brief covers the financial transactions of the company from the time the old horse-car lines were bought up, consolidated and transferred into the present system.

It appears from the brief that the original lines were purchased by the North American Company and by it sold to the Milwaukee Street Railway Company, which it controlled, for over $3,000,000 in excess of the original purchase price. When the property of the Milwaukee Street Railway was sold by the receiver in 1896 it was bought for $6,500,000 and was turned into the present company on the same day for $14,000,000.

The engineering staff of the commission made an appraisal of the property of the company in 1896, which Mr. Manson accepts as the proper basis of determining the value of the investment. He objects, however, to certain items being included in the value of the property, such as the cost of paving between the tracks, the proper apportionment of the cost of power houses as between city and interurban service, etc., which matters the commission will consider. The brief also states that the cost of reproducing the property has been increased over $1,000,000 by charges to operation through depreciation reserve, and that the cost of reproducing the property in the inventory exceeds the investment upon which a return should be allowed. The investment of the company, according to the city's basis of figuring, is given for each year from 1894 to 1907, inclusive, and is shown as $6,560,665.47 on Jan. 1, 1907.

A large portion of the brief is devoted to a discussion of the subject of depreciation. Mr. Manson has computed the actual depreciation which has accrued on the property by analyzing the expenditures for construction and replacement during the last fourteen years, and his results vary only one-fifth of 1 per cent from the estimate of the commission's engineers.

The final results upon which the city contends it is entitled to secure a reduction in rates are as follows:

Gross earnings, 1907	$3,221,912.44
Operating expenses, depreciation, taxes	1,898,533.12
Profit	$1,323,379.32

A 6 per cent return on the investment as given above would be $393,639.92 and an 8 per cent return would be $524,853.23. Mr. Manson contends that the highest rate of return that could possibly be considered is 8 per cent, and that the present earnings exceed this by $798,526.09. The proposed reduction in rate would, on the basis of the number of passengers carried in 1907, reduce the gross earnings $582,396.67, which would leave a surplus of $216,129.42 for improving the service.

The proceedings in this case were begun over three years ago, but the enormous mass of details which has to be considered by the commission before any intelligent conclusion can be drawn will require considerable time still.

The Wisconsin Telephone Company has filed a complaint with the commission alleging that the Common Council of the City of La Crosse has passed certain ordinances which are unreasonable and void. These ordinances concern the removal of all telephone poles from certain designated streets in the City of La Crosse as well as from the so-called brick-paved district. The company claims that its poles in the affected district carry local wires, both bare and in aerial cables, as well as its toll lines which must necessarily pass through the city, and avers that inasmuch as its toll lines cannot be placed in cables, either aerial or underground, but must be conducted on open wires, any reconstruction would be attended with great practical difficulty and a considerable expense. It would involve crippling the service and the institution of condemnation proceedings to acquire certain rights-of-way which the local conditions would make necessary if the lines were to be removed from the particular streets involved. Without regard to the expense involved it would be impossible to complete such condemnation proceedings within the time limit set by the Council. The hearing has been set for Nov. 18.

A preliminary assessed valuation of $42,788,000 has been placed on the street-railway, light, heat and power utility companies of Wisconsin by the State Tax Commission. This is an increase of $2,318,000 over the preliminary valuations of the past year. The largest increase was made with the Milwaukee Electric Railway & Light Company, from $23,500,000 in 1910 to $24,400,000, an increase of $900,000. The assessment of the various street-railway, heat, light and power companies is as follows:

Milwaukee Electric Railway & Light Company	$24,400,000	Kenosha Street Railway	$275,000
Milwaukee Light, Heat & Traction Company	6,950,000	Menominee & Marinette Light & Traction	240,000
Milwaukee Northern Railway	1,650,000	Ashland Light, Power & Street Railway	285,000
Wisconsin Traction, Light, Heat & Power	1,150,000	Chicago & Milwaukee Electric	180,000
Chippewa Valley Railway, Light & Power	1,000,000	Merrill Railway & Lighting Company	120,000
Duluth Street Railway	875,000	Manitowoc & Northern Traction	120,000
Sheboygan Light, Heat & Traction	865,000	Grand Rapids Street Railroad	110,000
Southern Wisconsin Railway	850,000	Beloit Traction Company	110,000
Eastern Wisconsin Railway & Light	775,000	Waupaca Electric Light & Railway	86,000
Green Bay Traction	705,000	Twin City General Electric	45,000
Wisconsin Electric Railway	650,000	Janesville Street Railway	37,000
Wausau Street Railroad	500,000	Bay Shore Street Railway	20,000
La Crosse City Railway	460,000	La Crosse & Onalaska Street Railway	20,000
Rockford & Interurban Railway	310,000		

These preliminary valuations are subject to review and correction after hearing, which will be held before the State Tax Commission.

Maryland Commission News.

The Maryland Public Service Commission completed its telephone hearing last week and is holding the case under advisement. It is reported that the new schedule of rates which was recently proposed by the Chesapeake & Potomac Telephone Company will not be sanctioned, and that the commission will offer suitable suggestions which the company will favorably consider.

The commission approved the City Council's grant to the United Railways Company of the right to lay tracks on the widened portion of Light Street. There were no protests against this grant. The tracks will be laid between Baltimore and Lee Streets and the Orleans Street cars will be run over them.

Arguments on the question of whether the City of Baltimore

should be compelled to pay a percentage of the salaries of the members of the commission were begun last week before Judge Stockbridge in Circuit Court No. 2. Several months ago Attorney David Stewart, in behalf of the Auxiliary Realty Company, filed a petition for an injunction against the Mayor and City Council to restrain them from paying a part of the salary of the commission, as provided by an act of the last Legislature. The Auxiliary Realty Company claims that as a taxpayer it has the right to apply for such an injunction. Mr. Stewart contends that Article 15, Section 1, of the Constitution prohibits any commissioners under the laws of the State of Maryland from receiving more than $3,000 a year as salary. The chairman of the Public Utilities Commission receives $6,000 a year and each of his two associates $5,000 a year. Of this amount the City of Baltimore is to pay $3,000 a year to the chairman and $2,000 a year to each of the other two members of the commission. Attorneys William Cabell Bruce and Albert C. Ritchie, of the Public Service Commission, and Sylvan H. Lauchheimer argued on the demurrer of the city.

New Jersey Commission News.

The Board of Public Utility Commissioners for the State of New Jersey has issued a certificate of approval of a proposed issue by the Crosswicks Water Company of capital stock to the amount of $7,500 and of bonds to a like amount.

The board has approved of an ordinance of the Town of West Orange granting permission to the Public Service Railway Company to construct and operate so much of a connection between the southerly track of the Public Service Railway Company's street railway in Main Street and track on private right-of-way south of Main Street as lies within West Orange.

The board has also approved an ordinance of the Town of West Orange granting to the Public Service Railway Company the right to construct and operate street railway connections between the single track in Harrison Avenue and the single track in Eagle Rock Avenue, in the Town of West Orange.

AMERICAN ELECTRICAL ENGINEERS—XIX.

W. C. L. Eglin.

William Charles Lawson Eglin was born in Glasgow, Scotland, July 14, 1869, and received his scholastic training at the Andersonian University of that city and at the West of Scotland Technological College. After graduation he assisted Mr. Rankin Kennedy in his early experimental work on alternating-current generators and transformers.

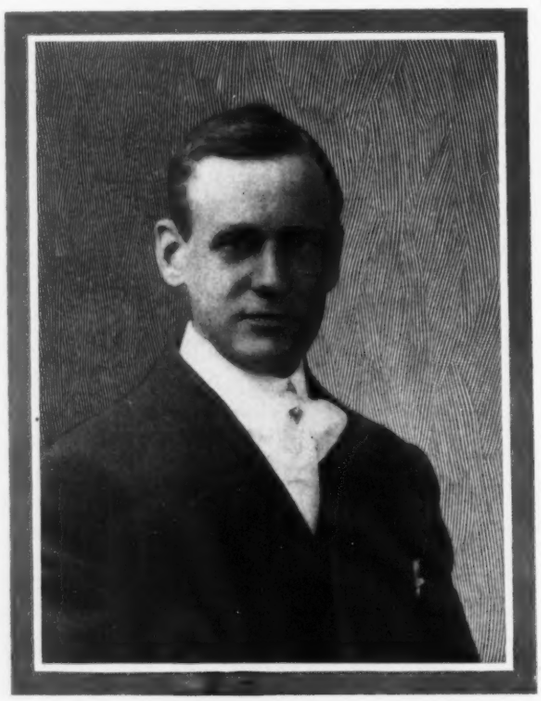
In 1889 Mr. Eglin came to the United States, where he joined the Edison Electric Light Company of Philadelphia, and under Professor William D. Marks, then at the head of the Edison company, had charge of the electrical construction of the first modern central-station plant in that city. Later he was advanced to the position of engineer in charge of the electrical department, and continued in this position until the consolidation of the Edison company with the Penn Heat, Light & Power Company in 1896. Some time after this he was appointed electrical engineer of the Philadelphia Electric Company, which controls all the electric lighting companies in Philadelphia and vicinity.

Mr. Eglin's work after the consolidation of the various companies involved practically rebuilding and rearranging the entire system, in order that uniformly satisfactory service could be furnished throughout the city. To this end several generating stations were enlarged, others remodeled as substations and a new generating station built at Twenty-eighth and Christian Streets (described in our issues of May 27 and June 3, 1909). This latter station, which was designed upon the unit basis, has a present capacity of 36,000 kw and is capable of being expanded to an ultimate capacity of 120,000 kw. The total number of substations built and equipped is thirteen.

The design of the substations—especially the alternating-current substations—was worked out by Mr. Eglin with a view to making the alternating-current distributing system as flexible as possible, in order to meet greatly varying requirements of service. Philadelphia is the leading manufacturing city in the United States, and some of the districts served are largely manufacturing, others are residential and still others demand both manufacturing and residence service. Throughout, Mr. Eglin's aim has been to reduce to a minimum the work of the operator, confining it so far as possible to keeping the stations and apparatus clean. Some of the smaller substations have been designed to operate without an attendant, an inspector merely visiting the plant occasionally to see that everything is in proper working order and that cleanliness is maintained.

Mr. Eglin has taken an active part in all matters relating to the company's progress, and has given particular attention to the various educational and beneficial organizations within the company, formed to enable employees to improve their condition. There are at present three organizations in the company, namely, a company section of the National Electric Light Association, which includes a former meter society as a branch; a beneficial association and an athletic association.

Mr. Eglin represented the Franklin Institute and the Engineers' Club of Philadelphia at the International Electrical



W. C. L. Eglin.

Congress held in Paris in 1900, and was a delegate of the Association of Edison Illuminating Companies to the International Electrical Congress held in St. Louis, 1904, where he presented a paper on rotary-converter and motor-generator city distribution. He has taken an active interest in the affairs of the American Institute of Electrical Engineers, having served as a manager and as a vice-president of that body and as chairman of the Philadelphia section. In 1903 he presented a paper before the institute on safeguards and regulations in the operation of overhead distributing systems, and he has frequently contributed to the discussions of papers. He has also contributed largely to the proceedings of the Association of Edison Illuminating Companies.

Mr. Eglin has been closely identified with the National Electric Light Association, and has occupied in that body the offices of secretary and treasurer, second vice-president and president. During his term as president (1908-1909) the association made great strides in activity, the membership being more than doubled, while the balance in the treasury was materially increased. As chairman of a committee on steam turbines in 1904, and chairman of a committee on gas engines and gas producers in 1908, Mr. Eglin submitted two exhaustive and valu-

able reports on the relation of these prime movers to the central-station industry.

Mr. Eglin is also a member of the American Electrochemical Society, the Illuminating Engineering Society, and one of the Board of Managers of the Franklin Institute; member of the Engineers' Club of New York, the Engineers' Club of Philadelphia, the Bryn Mawr Polo Club and the Racquet, Merion Cricket, Pen and Pencil, Country and Union League Clubs, of Philadelphia, and the Mohawk Club, of Schenectady, N. Y.

CURRENT NEWS AND NOTES.

Assistant Electrical Engineer Examination.—The State Civil Service Commission, Albany, N. Y., will hold an examination on Dec. 15 for the position of assistant electrical engineer. The salary is $600 to $900, with maintenance.

Meter Tests.—Of 32,552 gas meters tested during the month of October by the New York City Public Service Commission 55.8 per cent ran fast and 6.2 per cent slow, leaving only 38 per cent as complying with the legal requirement. Of the electric meters tested during the same month, 3.6 per cent were fast, 3.6 per cent slow and 92.8 per cent correct.

Philadelphia N. E. L. A. Sectional Meeting.—A meeting of the Philadelphia Electric Company Section of the National Electric Light Association will be held on Monday evening, Nov. 21, at which the following papers will be read: "The Increasing Prominence of Illuminating Engineering, as Recognized by Technical Societies and Universities," by Mr. G. Bertram Regar; "The Possibilities of Electricity," by Mr. James H. Dentry.

N. E. L. A. Transactions.—Owing to the strike of express employees the delivery of the 1910 *Transactions* of the National Electric Light Association, the publication of which this year was ahead of the usual date, has been somewhat delayed. The two volumes this year include 2070 pages and 483 illustrations, and the edition reaches 7000 sets, or 1500 more than last year, representing about 2800 tons of printed matter. Many of the State and county sections are now so large that the volumes in many instances are being delivered in bulk to the local secretaries for final distribution by them.

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on Nov. 9 President F. P. Vose alluded with regret to the defeat of Mr. R. R. McCormick as president of the Board of Trustees of the Sanitary District. Mr. McCormick was a recent speaker before the club and made a favorable impression. He was an unsuccessful candidate for re-election on Nov. 8. A report from the treasurer was read, showing that the club has a balance on hand of $3,274.45. There was a good attendance. Mr. James Lyman, of the General Electric Company, read a paper on "Recent Hydroelectric Developments in the West," which was followed by a discussion.

Inverted Pole-Type Switches.—The North Shore Electric Company, Chicago, is using for its pole-top disconnecting switches an underslung type which is mounted beneath the cross-arm, where it is more accessible than the usual form inserted directly between the span insulators. In the new construction the spans are dead-ended on tandem petticoat insulators, jumpers being tapped under the arms to the inverted switch mounted on insulators. A slight bend in the clips of the switch holds the knife in a closed position unless a pull exceeding 15 lb. is exerted on it. The inverted arrangement makes the switch much easier to get at and to operate than with the old construction, where the line circuits had to be penetrated.

Cost of New York's Transportation Facilities.—It is estimated that, exclusive of the improvements involving the installation of electrical equipments by steam railroads, the improvements in electrical transportation facilities in Greater New York during the past ten years have cost $285,000,000. This amount is made up as follows: Manhattan subway, $94,000,000; Hudson tunnels, $68,000,000; elevated railways, $31,000,000; surface railways, $50,000,000, and Brooklyn Rapid Transit improvements, $42,000,000. In addition to the above, electrical railway equipments have been introduced by the Long Island Railroad, the Pennsylvania Railroad, the New York Central & Hudson River Railroad and the New York, New Haven & Hartford Railroad.

John Fritz Medal.—The John Fritz medal for 1910 has been awarded to Mr. Alfred Noble, past-president of the American Society of Civil Engineers, "for notable achievements as a civil engineer," and will be presented at a public meeting to be held on the evening of Nov. 30, 1910, at 8:30 o'clock, in the house of the American Society of Civil Engineers, 220 West Fifty-seventh Street, New York City. The program will be as follows: (1) "The John Fritz Medal," by Dr. Samuel Sheldon, Brooklyn Polytechnic Institute. (2) "Civil Engineering," by Mr. Isham Randolph, Chicago. (3) "The Life and Works of Alfred Noble," by Dr. Rossiter W. Raymond, secretary American Institute of Mining Engineers. (4) The presentation of the medal by Mr. Henry R. Towne, president New York City Merchants' Association. (5) Acceptance of the medal by Mr. Alfred Noble.

Engineers Discuss Smoke Prevention at Boston.—A joint meeting of engineers for the purpose of discussing smoke prevention and the economics of combustion was held at the Edison Building, Boston, on the evening of Nov. 10. The meeting was held under the auspices of the Boston Section of the American Society of Mechanical Engineers, with the co-operation of the Boston Society of Civil Engineers and the Boston Section of the American Institute of Electrical Engineers. The meeting was well attended and much interest was shown in the smoke-prevention problem in view of the recent law in Massachusetts which places jurisdiction over smoke in the hands of the Gas and Electric Light Commission. Chairman Ira N. Hollis, of the Boston Section of the A. S. M. E., presided, and after a short business session introduced Mr. Dwight T. Randall, combustion engineer, with Mr. Arthur D. Little, Boston, who read an exhaustive paper entitled "The Problem of Smoke Abatement in New England." Special attention was given to practice in hand-fired plants.

Meetings of the New York Section, I. E. S.—At a meeting of the New York Section of the Illuminating Engineering Society held on Nov. 11 Mr. A. J. Marshall, as secretary of the section, outlined the paper read and discussed at the recent Baltimore convention of the society and the lectures on illuminating engineering delivered at Johns Hopkins University. The convention and the lecture course were then discussed by Messrs. A. H. Elliott, H. T. Owens, E. N. Hyde and A. S. McAllister. Prof. G. S. Macomber described the course in illuminating engineering being given at Cornell University, in which use will be made of the information acquired during the Johns Hopkins lecture course in so far as it can be applied to the conditions at Cornell. The secretary announced that at a meeting of the section to be held on Dec. 8 two papers will be presented. A paper by Prof. E. L. Nichols will deal with the early history of photometric standards. Mr. Bassett Jones, Jr., will present a paper entitled "The Lighting of the Allegheny Soldiers' Memorial Building in Pittsburgh." This paper will be illustrated by means of colored lantern views. Printed copies of the paper will be distributed two weeks or more prior to the meeting. Three papers will be read at the January meeting of the section, the authors being Dr. P. W. Cobb, Dr. Nelson M. Black and Mr. Paul Bauder. At the February meeting of the section Mr. Bassett Jones, Jr., will read a paper entitled "A Study of Reflecting and Diffusing Media."

Argentine Wireless.—The Argentine government has appropriated $8,500 United States currency for a wireless-telegraphy station at Mendoza, which will be in direct communication with Valparaiso, Chile.

Concrete Poles in Toronto.—The Toronto hydroelectric department will light a number of residence streets with tungsten lamps in a new design of lantern on concrete poles. About 550 poles are now being erected.

Ohio Public Utilities Bill.—Senator Carl H. Keller, of Columbus, has announced that he will introduce another public-utilities bill at the next session of the Legislature, which convenes in January, 1911. He says it will be a real utilities bill "with teeth."

Long-Distance Wireless.—Wireless telegraph communications have passed between the Marconi stations at Coltano, near Pisa, Italy, and Clifden, Ireland, and Glace Bay, Nova Scotia. It is reported that the opening of the new service will result in a lowering of the transatlantic rates for wireless messages.

Christmas Turkeys for Central-Station Employees.—The Commonwealth Edison Company of Chicago will make a Christmas present of a turkey to each employee of the company who will have been in the service of the company for one year or more on Dec. 25, 1910. The undertaking will mean the distribution of probably more than 2000 turkeys.

Denver Electric Club.—Mr. Charles J. Babcock, chairman of the publicity committee of the Denver Chamber of Commerce, was the speaker at the regular weekly luncheon of the Colorado Electric Club on Nov. 10. His subject was "Salesmanship and Advertising," with special reference to the value of such methods applied to the publicity of Colorado's resources.

Ohio Bell Telephone Society.—A meeting of the Ohio Bell Telephone Society will be held at Columbus on Monday evening, Nov. 21, when about twenty-five prominent telephone men outside the State will be guests of the organization. Points of interest will be discussed and a banquet will be served at one of the hotels. This society is made up of officials of the Bell companies in the State and comprises a large membership.

Subways and the Building Code.—Chicago is considering the adoption of a new building code and Mr. B. J. Arnold, chief subway engineer, has written to Mayor Busse to point out that the code should take into account the construction of future passenger subways. In streets where subways may be constructed foundations of all buildings under six stories, or 75 ft. high, should be carried to the depth of the subway structure. All buildings over 75 ft. high should rest upon caissons carried to rock.

Baltimore Scientists' Club.—The first meeting this year of the Baltimore Scientists' Club was held at the Baltimore City College last week. Prof. L. J. Ingham, of the scientific department of the college and president of the club, delivered a lecture on the McCall's Ferry hydroelectric plant preliminary to the trip which the members of the club made to the plant the day following the lecture. The club consists of the teachers of science in the principal secondary schools of Baltimore. A special car conducted the party to McCall's Ferry and an inspection was made of the entire plant.

Safety Locks for Crane Controllers.—The Illinois Steel Company is equipping the controller handles of the various motor-driven cranes and carriages about its mills and open-hearth furnaces with automatic safety snap locks which can be closed to hold the controller in the off position until released by an authorized operator with a key. Serious accidents, some of them fatal, have resulted from men scuffling near controllers or carelessly handling them when the regular crane operators were out of the building, and the new locks now being installed are intended to prevent the recurrence of these accidents.

Nelson and Saskatchewan River Water-Powers.—Hon. William E. Ogilvie, former Governor of Yukon, has stated that his observations during a recent trip to the Nelson and Saskatchewan indicated that there is 1,000,000 hp available for development on these rivers. On the Nelson River at White Mud Falls there is alone 350,000 hp, and the same power can be developed at Grand Rapids on the Saskatchewan. These powers are within a radius of 100 miles of the proposed Hudson Bay Railway, and Mr. Ogilvie advocates the adoption of electric traction for that line. The matter will be brought to the official attention of the Dominion government.

Telephone Service in Chicago.—At a recent meeting of the City Council of Chicago an ordinance was introduced requiring the installation by telephone companies on all telephones equipped with coin boxes of meters to record outgoing messages. The proposed ordinance was referred to the committee on gas, oil and electric light, which is investigating the general subject of telephone rates. Another alderman secured the adoption of a resolution directing the Corporation Counsel to report whether the ordinances of the Illinois Telephone & Telegraph Company (Illinois Tunnel Company successor) are now in force and effect. These ordinances go back to 1899 and require that company to give unlimited service from business and residence telephones for $85 and $50 a year, respectively.

New Washington Street Tunnel Under Chicago River.—A novel reconstruction of the old Washington Street tunnel under the Chicago River will shortly be opened for the passage of the electric cars of the Chicago Railways Company. As originally built, this masonry tunnel was only 16 ft. below the mean level of water in the river, limiting the draft of vessels in the Chicago River at that point. The reconstructed tunnel is 26 ft. below the river surface. Parts of the original masonry walls of the structure were retained, the roof was taken off and rebuilt on steel girders supported on the walls, and the floor lowered sufficiently to allow electric cars to pass. The entire tunnel is 1200 ft. long, of which 200 ft, is subaqueous. The west approach extends beneath the new terminal station of the Chicago & Northwestern Railroad. The track grade is 46 ft. below the river level, and the bore section measures 16 ft. x 25 ft. The reconstruction work has been completed by an interesting use of compressed air for sustaining the rock masses during the work. The method used was one devised for this work by Mr. George W. Jackson, of George W. Jackson, Inc., which did the work.

Students' Wireless-Telegraph and Aeroplane Equipment.—The students of the school of engineering at the Pennsylvania State College are installing a wireless-telegraph station designed for communication with stations at Washington, New York, Philadelphia, Boston and elsewhere. Among the uses to be made of the apparatus will be the reporting of football games played by the college team in other cities where suitable wireless-telegraph equipments have been installed. There is also being erected a level circular track, 200 ft. in diameter, for making tests upon aeroplanes and propellers. A car driven by an electric motor will run upon the track at speeds up to sixty miles per hour. To this car will be attached the planes or propellers to be tested. The frictional resistance or lifting power of the planes and the propelling force and efficiency of propellers will be determined through a series of dynamometers which record by electrical means on instruments placed upon a platform in the center of the circular track. The problem of plane shape and surface can be readily studied by this apparatus, as can also those relating to the shape, size and speed of propellers.

ELECTRIC GENERATING AND DISTRIBUTING SYSTEM IN READING, PA.

Combined Lighting and Railway Equipment of the Metropolitan Electric Company.

THE Interstate Railways Company is a corporation of the State of New Jersey, with headquarters in Philadelphia, under which are combined a large number of public service corporations in the States of Pennsylvania, New Jersey and Delaware. The most important group of these subsidiaries is formed by about a dozen railway and lighting companies in and about Reading, Pa., all of which are now leased to the Reading Transit Company. Among the underlying companies of the transit company is the Metropolitan Electric Company, of Reading, which acts as the sole generator and distributor of energy to the following public utilities: Reading Traction Company, Reading Power Company, Reading Electric Light & Power Company, Reading & Southwestern Street Railway Company, Front & Fifth Street Railway Company, Birdsboro Street Railway Company, Oley Valley Railway Company, Adamstown & Mohnsville Electric Railway Company, Neversink Mountain Railway Company and Neversink Mountain Light & Power Company.

The foregoing corporations serve the entire County of Berks, and also parts of Lebanon and Montgomery Counties. The population served by the Reading Transit Company is about 150,000. The officers of this company are as follows: President, H. G. Louser; vice-president and general manager, W. A. Rigg; treasurer, H. H. Reigel; engineer, C. C. Long.

The system in use before the construction of the station described hereinafter consisted of a main generating plant on Seventh Street, Reading, composed of four brick buildings, which had been constructed from time to time as the needs of the system required. Three buildings were devoted to engines and generators and one was used for boiler rooms and miscellaneous purposes. The total rating of this plant was about 7000 hp. Not only was the equipment insufficient for the rapidly growing territory, but the generating apparatus itself had become antiquated. Outside of this plant were two rotary substations to which high-tension energy was supplied by means of 25-cycle inverted rotaries fed with energy from the railway generators.

The generating station at Reading serves practically all the territory included in Berks County. This is accomplished by means of high-tension feeders to the two substations already in operation at Shanesville and on the Oley line, and to four new ones located at Ringing Rocks. Wernersville, Mount Penn and Mohnton. A portable substation is provided also for emergency conditions. Each substation contains one 500-kw rotary and air-blast transformer, except Mount Penn, which has two units, and the main substation on Seventh Street, Reading, which has four 500-kw units. Under the old system the Shanesville and Oley line stations received energy at 15,000 volts, 25 cycles, and consequently it was necessary to change their apparatus to suit the new conditions.

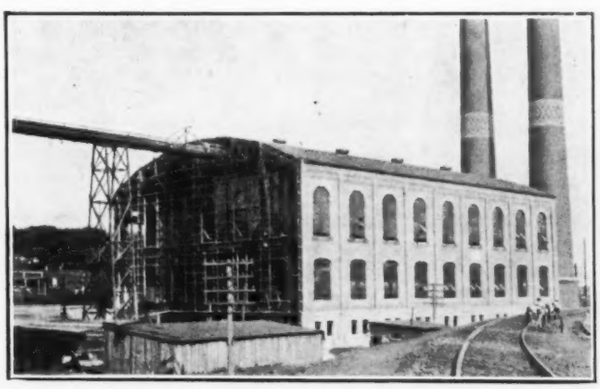


Fig. 1—View of Main Station, Showing the Conveyor Run and Temporary End in Process of Erection.

The lighting and motor service systems in Reading have been left undisturbed as far as possible, the only change being the withdrawal of all two-phase motors and the substitution of single-phase and three-phase motors. The Edison three-wire direct-current lighting system, serving the central portion of the city, was shifted from the generators in the old plant to the lighting rotaries in the new main substation at the same site. Future extensions of the service will be made from the three-phase lines wherever possible. The street-lighting system in Reading is composed of magnetite arc and tungsten incandescent series lamps. From 40 per cent to 50 per cent of the total output is for railway service.

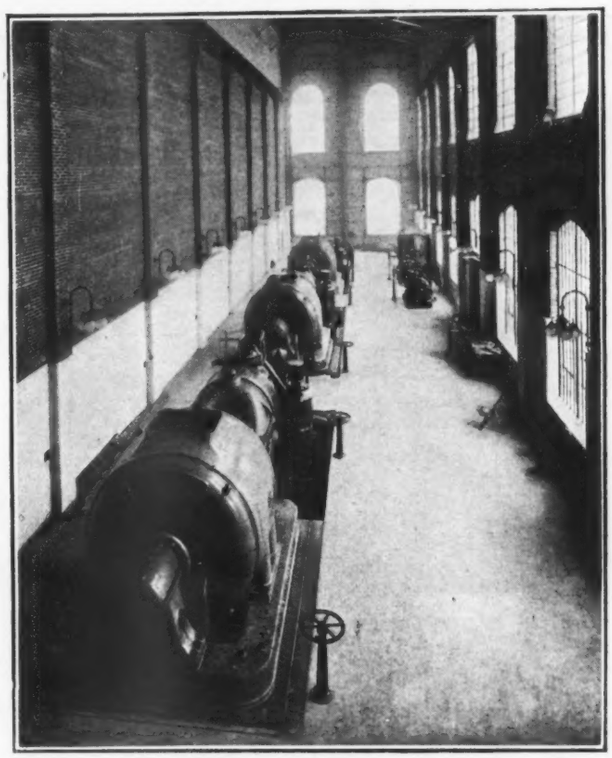


Fig. 2—Interior of the Turbine Room.

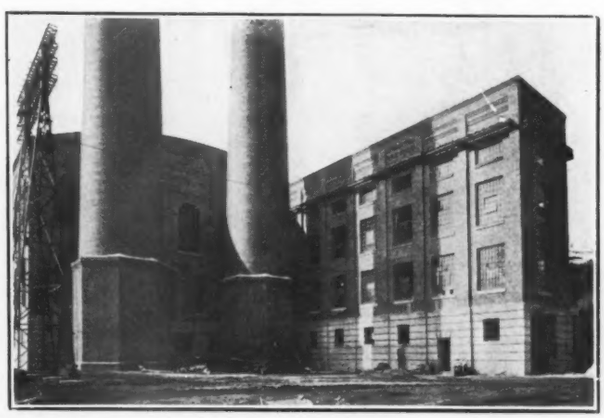


Fig. 3—Front of Main Station, Showing Switch House Annex and High-Tension Tower at Left.

THE NEW GENERATING STATION.

The new generating station is located in West Reading along the Schuylkill River, adjacent to the Pennsylvania and Philadelphia & Reading railroads. These railroad connections furnish excellent facilities for the delivery of building material, machinery and fuel. The shape of the plot made it necessary to lay out the different portions of the station in a rather unusual manner. There was only room enough between the

Pennsylvania Railroad's main line right-of-way and the property line opposite to permit the construction of the boiler and turbine rooms, which are 174 ft. x 88 ft. and 174 ft. x 38 ft., respectively.

A more favorable building cross-section could not be secured because the adjoining property was in litigation. To provide room for the rotaries, transformers and switch apparatus it was, therefore, necessary to build an annex running on to the narrow river end of the property. This annex is 113 ft. long, 38 ft. wide at the turbine-room end and 26 ft. wide at the front. If the building had been located far enough back to allow sufficient width to place the switch gallery between the turbine and boiler rooms not enough room would have been left to allow extensions. Furthermore, the increased length of the condensing-water duct and the additional excavations required by the upward slope of the land would have added materially to the cost of the plant. The natural slope of the land at the river end was so slight that a comparatively level area was available for most of the space needed for the station and only a relatively small amount of excavation was required to provide sufficient drainage area from the building under ordinary conditions. The basement-floor grade of 87 was placed above ordinary floods, only slightly below bad ones and near enough to the highest recorded flood grade of 94.5 to permit complete protection for the turbine-room basement auxiliaries, while the lift for the circulating water pumps at the extreme low-water grade of 74.5 was within reasonable limits.

To protect the auxiliaries from water at the maximum high-water level during the spring freshets, it was necessary to waterproof the turbine-room basement to an elevation of 8 ft. higher that the present basement floor. All the stairways and other openings were placed above the maximum high-water line except the opening in the end adjoining the switch-house, where provision was made for a railway track to deliver machinery. At this track entrance there is installed a wooden gate which is always in place except on the rare occasions when it is necessary to bring machinery parts under the floor hatch in the turbine room.

The station building is a steel-frame structure with brick walls resting on concrete basement walls which are carried up to the level of the first floor. The foundations are of rock, concrete-capped piling or solid ground, the differences being due to the extremely irregular geological formation at this place. As the low-water level of the river was 74.5 at grade, the bottom of the foundation was taken at grade 74 in order to make sure that the piling would always be moist. Concrete basement walls were chosen in preference to stone to give the finished building the proper architectural effect. The brick walls above the first floor are thick enough to take approximately half of the wind pressure on the sides of the building, leaving the steel framing to take the other half. Allowance for wind pressure was an important factor in the construction, as Reading is located in a mountain valley subject to frequent storms.

The top of the structure has an unbroken curved roof, which is quite a variation from the ordinary station construction. This type was adopted in order to avoid all gutters, to simplify possible extensions and to attain a more graceful appear-

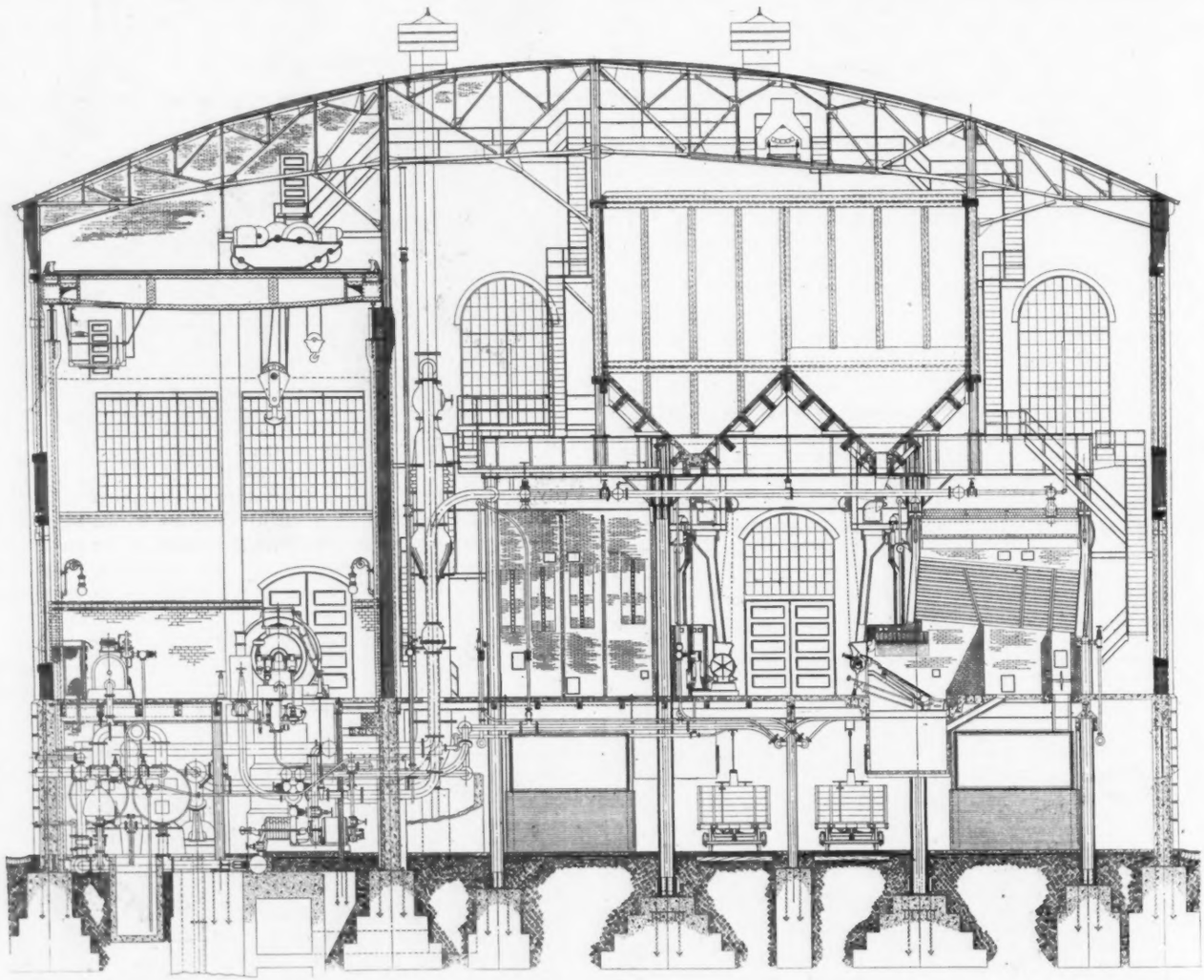


Fig. 4—Cross-Section Through the Power Station, Showing the Principal Construction and Equipment Features of the Boiler and Turbine Rooms.

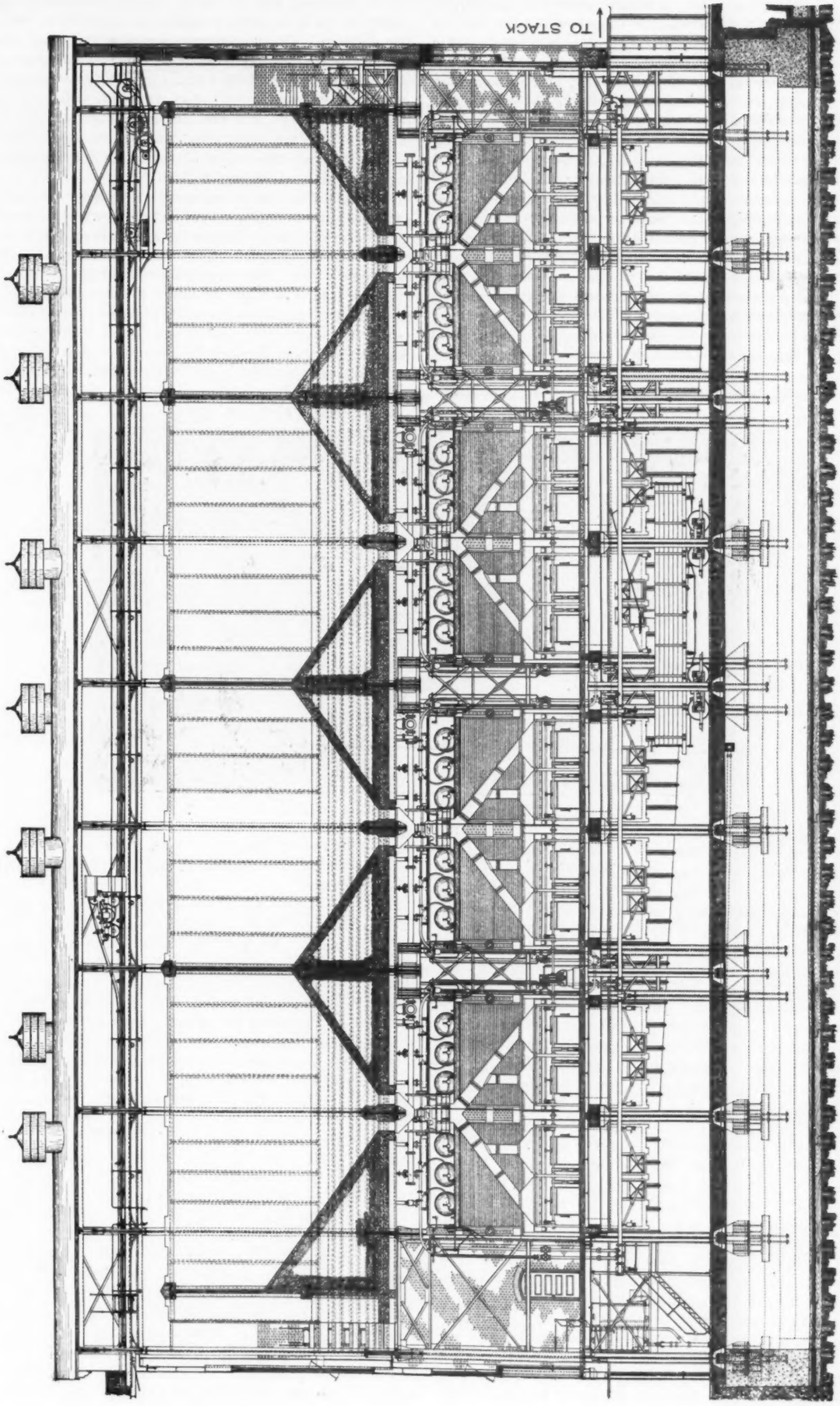


Fig. 5—Longitudinal Section Through Boiler Room.

ance. The supporting truss, although apparently continuous, is made in five sections which are supported by the various column systems carried up to it. The clearance required for the coal conveyor was such that the bottom chord of the roof truss could be curved, with the dual object of improving the architectural appearance and bringing the depth of the unit trusses within the proper shipping height.

The roof framing carries 3-in. reinforced concrete Roebling slabs covered with three-ply roofing felt. Owing to its curved form, the slope of the roof varies from flat at the center to about one-quarter pitch at the sides, which is considered within the limits of safe practice for asphalt roofs. The roof of the switchhouse annex has a slope of ¾ in. per foot and is supported by the usual shallow Pratt truss, with sloping top chord.

The switch-house, as an annex to the main building, has different panel lengths to suit the electrical apparatus, and it, therefore, required different treatment. It was decided to build this portion with flat top windows and to use flat top parapets slightly lower than the main building instead of the curved roof of the latter.

The question of future extensions determined to a great extent the general design of this station. It is so arranged that extensions up to double the present rating can be made, and the additional pair of chimneys required will be placed at the extended end in the same relation to the building as the present pair. The final boiler installation will be symmetrical about the present end bay.

According to the original plan the temporary wall at the extension end of the power house was to be of brick, laid in lime mortar to facilitate removal. The revival of business, however, created such an increased demand for service that it seemed likely that an addition to the present structure would be required very soon. Consequently, a partition of sheet metal supported on girts and columns and stamped to represent brick work was installed instead of a brick wall. This construction lends itself more readily to dismantling, as the bolted connections can be removed and re-erected as often as desired.

BOILER-ROOM CONSTRUCTION DETAILS.

The boilers are hung from columns which form a part of the steel building framing, and the coal bunker rests upon girders supported by the front and rear columns of the boiler settings. The side columns of the coal bunker are carried from these girders up to the roof framing, which they help to support. The boiler columns, together with the wall columns, support the first floor and the ash bins and flues underneath.

The width of the coal bunker was determined by the proper relation of the space between the boiler fronts to the space required between the boiler fronts and the walls, as well as by the proper division of the roof into separate truss units. As a result, one side of the coal storage is placed on the center line of the building and the other side is symmetrical about the center of the firing floor, so that it is one-third of the width of the building. The coal-storage space will contain about 3900 tons. The coal bunker is made of concrete slabs, supported by steel beams, and is divided into compartments by cross-girders and vertical beams. Each compartment is directly over two opposite batteries. The ash bins are hung from the first-floor beams. They are constructed without the customary sloping bottom to secure the benefit of maximum holding capacity during the period of spring freshets.

A complete system of walkways reachable by a stairway at each end of the boiler-room was installed for operating the main steam valves. The walkways on each side are cross-connected. At each end of the building additional stairways of easy ascent run from these boiler walkways to the conveyor runways and machinery platform; an extension is carried through the middle wall and the turbine-room, over to the switch-house roof, by which the main roof can be easily reached. A floor hatch is placed at the chimney end of the boiler-room for convenience in transmitting parts for repair to the machine shop in the switch-house basement. Parts can be lowered through this hatch by a chain hoist almost directly onto the trucks in the basement and hauled on the level to the machine shop.

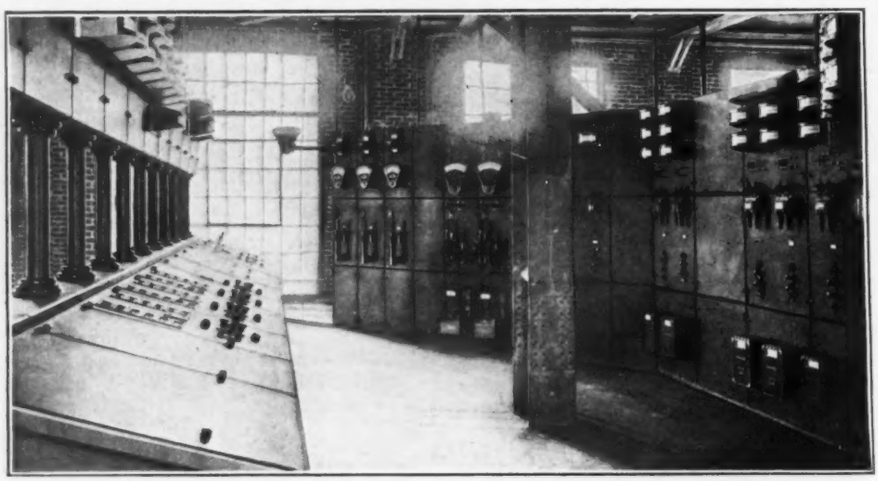


Fig. 6—Benchboard and Switchboard Looking Over the Turbine Room.

At the extension end of the building a clear floor area of 15 ft. has been left between the boiler setting and the temporary wall. The first two columns in this wall are designed for future boiler columns, so that in the completed plant there will be a 15-ft. clear area crossing the firing floor at right angles. Underneath this area, separated by the ash-car tracks, which run through the aisles between the front boiler columns, there are mezzanine floors with lavatories and lockers for the operators. These mezzanine floors are placed above high-water level and the space underneath them is available for future temporary extensions of the flues leading to the present chimneys. However, such extensions are to be used only until additional chimneys are installed, when the flues will end at the mezzanine floors as at present. The flues are placed directly under the boilers and are made up of steel plates, reinforced by angle ribs. They are 13 ft. wide with a level top and taper from a depth of 12 ft. 6 in. at the chimney end to half this depth at the mezzanine bay, which lesser depth is still large enough to permit the operation of an additional battery of boilers. The flues are supported directly from the floor girders and are anchored to the boiler columns at the chimney end.

Roof ventilation is attained by eight 48-in. Burt monitor ventilators. Three more ventilators of the same construction are installed on a line with four of these to receive the atmospheric exhaust pipes from the condensers. To obtain the best light and side ventilation for the building large windows were

planned with relatively small window panes and large ventilator areas. The "Fenestra" sash, made by the Detroit Steel Products Company, proved adaptable to these requirements. In addition, the end walls were designed so that large-sized doors would come at each end of the firing floor, while the coal bin was stopped a few feet from each end of the building to permit good ventilation through the upper windows and the roof ventilators.

SWITCH-HOUSE ANNEX.

The switch house contains a machine shop in the basement, rotary converters, transformers and office on the first floor; the main switchboards and oil switches on the second floor, and lightning arresters on the third or top floor. The construction here is similar to the usual brick and steel office building, except that the narrowness as compared with the height made careful provision necessary to resist the side wind pressure. Hence all floor girders were knee-braced throughout. The end frame, since the walls were brought back to the column centers, was sufficiently braced by the deep girders which carry the walls.

On account of the inclination of the property line at this side of the building it was necessary to incline one side of the switch house, reducing the width from 38 ft. at the turbine-room end to 26 ft. at the outer end. In addition to this the railroad track in the turbine-room basement, in order to reach the main-line railroad on the river bank, was curved sufficiently to necessitate offsetting the interior columns at the narrow end. The sloping sides make each roof truss different, while the offsetting of the interior columns in combination with the sloping sides, and the small crane run in the four bays at the inner end over the first-floor transformers, also make each column different from every other. The air duct necessary under the transformers was united with the cable gallery coming through the wall from the turbine-room basement. Reinforced concrete construction was adopted for this latter combination as the most satisfactory means of supporting the weights imposed and of furnishing enough working space to reach the transformer leads.

BOILER AND TURBINE EQUIPMENT.

The principal equipment in the boiler-room consists of sixteen 625-hp Edge-Moor horizontal water-tube boilers set two per battery. These boilers are equipped with Wetzel stokers driven from line shafts, each furnishing power for two batteries. The stokers are driven by a small vertical engine, but a complete spare stoke-engine unit is installed to provide for emergencies. These stoker engines, the air compressor and the honse-service water pumps mentioned later are the only reciprocating mechanisms in the entire power house.

Each battery of boilers has a coal scale delivering to the two stokers through a Y-connection, so that for running boiler tests the coal consumed by any one boiler can be accurately determined; and in case of a test of a turbine unit the coal required for the number of boilers furnishing steam for that unit can also be determined.

Two radial brick chimneys are now in service. Each chimney is 242 ft. high x 14 ft. inside diameter, and, as previously described, is provided with a steel rectangular flue carried under the first floor connected to eight boilers. This arrangement gives one extra pass for the flue gases in the boiler settings. It was, therefore, decided to dispense with economizers as being of questionable value under good operating conditions.

The turbine-room now contains three 4500-kw Allis-Chalmers horizontal three-phase turbo-generators delivering 13,200-volt, 60-cycle energy. These turbines take saturated steam at 200 lb. pressure. Their steam consumption guarantees per kw-hour are based on a pressure of 190 lb. at the throttle of the turbine and a vacuum of 28 in.: 2500 kw, 17.6 lb.; 4500 kw, 16.4 lb.; 5000 kw, 16.6 lb. These outputs are based on a power-factor of 80 per cent. Exciting current is furnished by two 100-kw General Electric horizontal turbine-driven units furnishing direct current at 125 volts.

By referring to the accompanying illustration of the turbine-room it will be noted that the machines have been placed in a single line parallel to the longitudinal walls of the building This arrangement leaves a clear space in which parts to be installed or dismantled can be moved with the crane to and from the hatchway without interfering with the machines in operation. The turbine-room is served by an 80-ton Shaw crane.

As provision for further growth may require larger turbine units and as it was not considered best to confine the possibilities to a horizontal type, the turbine-room was built high enough to admit the installation of the largest vertical turbine unit which might be required. Advantage was taken of this possibility to provide the large coal storage previously described by keeping the rest of the building up to the height of the engine-room.

An interesting feature of the lighting of the turbine-room is the use of clusters of four 75-watt tungsten lamps in single frosted globes. These give much steadier illumination than arc lamps and avoid considerable cost for maintenance, such as trimming, globe cleaning, etc.

STEAM PIPING.

The piping between the boilers and the turbines is so ar-

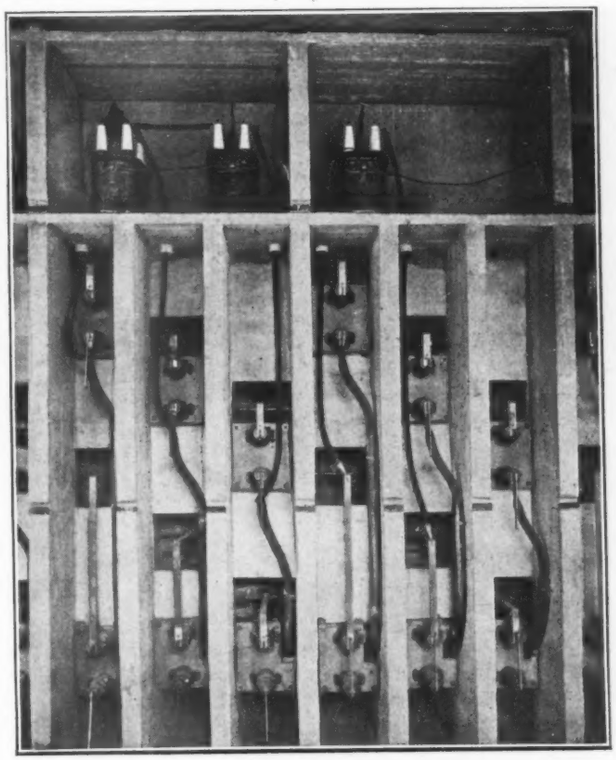


Fig. 7—High-Tension Cells.

ranged that it has the advantages both of a unit system and a duplicate main system, while being simpler than the latter. It is possible under all conditions to get enough boilers connected to furnish steam for any one turbine no matter what boilers are out of commission. The arrangement of the main steam pipes over the boilers is as follows: The boilers in each row are connected to a line running lengthwise over each set of boilers and the steam for the turbines is taken by cross-connections between two sets of boilers in each row. By an arrangement of valves where these cross-connections are made any turbine unit can be tested with two or four boilers by the closing of three valves, still leaving the other boilers connected to operate other units. While a turbine is being tested it may be desirable to operate its auxiliary from another steam source. This can be done by closing one valve in the turbine-room basement.

Owing to the fact that the turbines operate with a constant flow of steam it was possible to use smaller piping than if it had been necessary to supply the more fluctuating demands of reciprocating engines. The 6-in. steam connections from the boil-

ers are joined to 8-in. mains. A 10-in. pipe is used to cross-connect the mains at the places where steam is taken for the turbines. The 12-in. pipe from each cross-connection leads to that point in the turbine basement where the connections to the auxiliaries are made, whence a 9-in. pipe leads to the turbine throttle. In laying out the piping diameters the requirement at the turbine end was taken as the starting point instead of planning from the boilers.

All piping to the turbine exciters is carried under the floor, so that none is visible in the turbine-room except the risers through the floor to the machine. This gives the turbine-room a remarkably light appearance and avoids all trouble from drips and escaping steam.

AUXILIARIES.

In the turbine-room basement two Cochrane feed-water heaters and three Jeansville five-stage centrifugal boiler-feed pumps are placed at the end of the present building in such position that when additions are made to the plant the end turbine-room wall may be taken down and a duplicate system of heaters and pumps installed symmetrically along the line of the temporary end wall, thus keeping this apparatus in the middle of the completed plant.

Provision is made in the basement of the turbine-room for the house service water by two steam-driven duplex pumps. A single-cylinder steam-driven compressor furnishes the compressed air used for cleaning out the boiler tubes and for blowing dust out of the switch cells and machine frames. This compressor, by the way, is the only piece of apparatus transferred from the old plant to the new one.

The condensing equipment consists of Tomlinson barometric jet condensers with two heads on each condenser. This arrangement was used to take advantage of the difference in diameter between these heads and what would be required if a single head were used. The combined guarantees for the turbines and condensers are sufficient to insure good results without air pumps. Each condenser has its own centrifugal steam turbine-driven circulating pump, but these pumps are connected with a main so that by means of cut-off valves one pump may be made to supply the needs of another condenser if necessary.

The circulating water is taken from the Schuylkill River in a rectangular duct 6 ft. square which runs into the building directly under the turbine foundations. On top of this duct there is a similar 6-ft. x 6-ft. return duct, into which the hot wells discharge through openings in the foundation wall. On account of the conditions at this site the hot wells had to be constructed so that they would not be affected by floods. This necessitated the raising of the exhaust-pipe connections over the condenser heads to the barometric distance above the possible flood level.

The boiler-feed supply is taken from a dam in Wyomissing Creek at a point nearly one mile distant. A large pipe was necessary on account of the low head between this dam and the feed-water heaters. This pipe line was constructed of discarded boiler shells, which were available for low-pressure purposes. The shells varied in diameter from 30 in. to 40 in. and were jointed by means of concrete envelopes. In this way it was found possible to get head enough to allow the feed water to run into the heaters by gravity, and from the heaters to the pumps with sufficient head to allow them properly to handle hot water. The boiler-feed system consists of three five-stage centrifugal pumps driven by Kerr turbines. These pumps are designed for 700 gal. per minute at a pressure of 260 lb. The piping from these pumps consists of duplicate mains from the pumps down the length of the boiler-room basement. Each boiler has a front connection to one main and a rear connection to the other main, so that no possible breakdown of the piping short of a total disablement can prevent the feeding of any boiler. The feed water can be taken directly to the pumps in case the heaters are out of service. In emergencies, and as a feature of the regular practice of this plant, the circulating-water main is connected to the boiler-feed supply so that it is available in case of the failure of the supply line and can be periodically administered to the boilers as a purge for removing scale. The front-feed connections to each boiler are equipped with a feed-water regulator.

All of the auxiliaries exhaust at atmospheric pressure, the exhaust steam being used to heat the boiler-feed water.

COAL AND ASH-HANDLING EQUIPMENTS.

Coal is delivered over spurs from the Pennsylvania and the Philadelphia & Reading railroads, which run side by side at different levels on the same set of reinforced-concrete piers over the coal-storage platform and a track hopper which dumps directly to the crusher, whence the coal goes to the power-house bunker by way of a 24-in. belt designed for 180 tons an hour.

The surplus coal for outside storage is dumped between the concrete piers which support the dumping tracks. Directly under these piers there is a concrete structure which contains a tunnel with roof openings leading to a 36-in. belt conveyor. Ordinarily these openings are closed by cut-off gates. When stored coal is to be used the cut-off gates are opened from the floor of the conveyor tunnel by means of chains which enable the operator to control the amount of coal for the reclaiming conveyor. A loading device in the tunnel regulates the flow of coal to the belt. This conveyor delivers coal to the crusher for transmission to the generating station by way of the 24-in. belt previously mentioned. The latter belt attains the level of the lower chord of the station roof truss back far enough from the building to permit extending the structure in such a way that it would be necessary to disturb only the lower part of the conveyor support. This support consists of wooden bents on concrete piers. Coal to all divisions of the bunker or to any one of them is delivered by a traveling conveyor tripper.

Ashes are dumped directly from the ash hoppers underneath the stokers into full-sized ballast motor cars, which run through the basement. These ashes can be taken away for fills or dumped at any convenient point without rehandling.

HIGH-TENSION DISTRIBUTION AND UNDERGROUND CONDUIT SYSTEMS.

The main generator leads are carried in conduit along the basement wall into the switch-house basement and up the wall to the second floor to the switch cells. The underground feeders are taken in conduits directly down the wall and out through the foundation wall into a manhole, which is the entrance to the underground system hereinafter described. The conduits for the house-service feeders are also carried up the wall from the second floor to the third floor, which contains the lightning arresters. In general, all the high-tension wiring in the building is run in fiber conduit covered with concrete. To keep the window openings clear all conduits between the first and second floors are grouped in the spaces between the windows, the concrete being made to give the effect of wide pilasters.

The outgoing high-tension lines are taken out through 16-in. circular openings in the walls, the wires being supported on insulators both inside and outside. The outside insulators and supports are designed for dead-end strains. Provision is made for taking eight three-phase high-tension circuits out of the switch-house over the Pennsylvania main tracks in front of the building and from there distributing the circuits to the various substations. To accomplish this two extra heavy dead-end steel line towers were built to hold the maximum unbalanced load of 9000 lb. which the railroad company's standard specification required. The insulator clamps are designed to cover as far as possible the worst conditions of breakage and still to keep the wires in the proper position.

As the new station was built on the far side of the river at a distance of about one mile from the old plant, which has been converted to a main distributing station, it was necessary to provide a conduit system for the six three-phase feeders to the main substation in question. These feeders are carried under the river and underground through the streets of Reading except where they cross the Schuylkill Canal. On reaching this canal the feeders are brought to the surface and carried across alongside the highway bridge on a special bridge built by the American Bridge Company. This bridge has a decking over the conduit envelope which can be used as a sidewalk.

The accompanying views show some interesting features in regard to the underground approaches at the river bank on the Reading side. One novel construction is that going out from the river up to the first manhole. The cables are brought up out of the slots on to the shelves at the sides of the manholes by a system of sloping shelves. In another construction (not illustrated) the submarine cables from the generating station to the river are placed in a single layer in slots in the floor of the tunnel and are covered with removable concrete slabs. From the tunnel these cables pass through fiber conduits embedded in the concrete basement walls of the station up to the switches. The present installation comprises four three-conductor submarine cables, leaving available the remainder of the ducts for additional cables, either single conductor or otherwise. This underground line also has provision for a telephone cable connecting the generating plant to the main substation and a metallic ground connection from the railway grounds in Reading to the generating plant and the main substation.

SWITCH-HOUSE EQUIPMENT.

The first floor of the switch-house or annex building is level with the turbine-room floor. At present it contains two 500-kw Westinghouse railway rotaries and the necessary air-blast step-down transformers with provision for one more rotary and transformer equipment. There are also two transformers for the house supply for lamps and motors with space for a third installation. A hand crane of 6-ton rating is to be provided for handling this apparatus. The engineer's offices are located at the outer or front end of this floor.

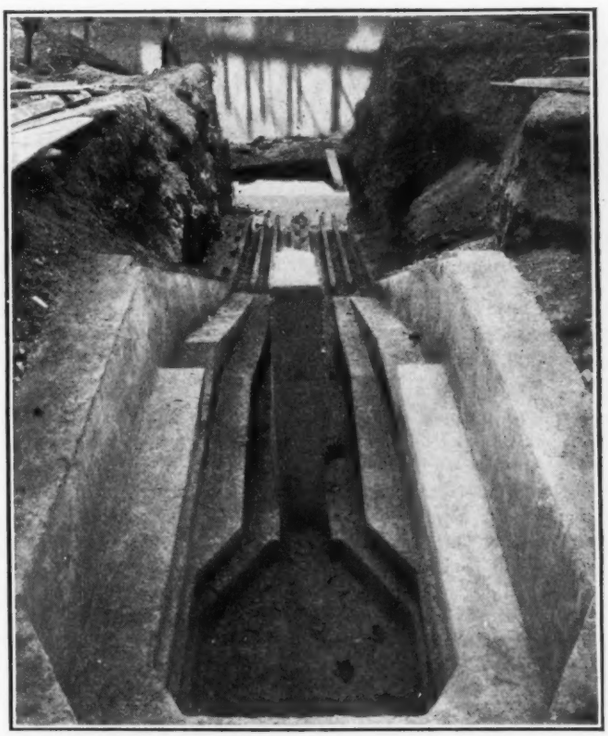


Fig. 8—High-Tension Conduits, Looking in the Direction of the River.

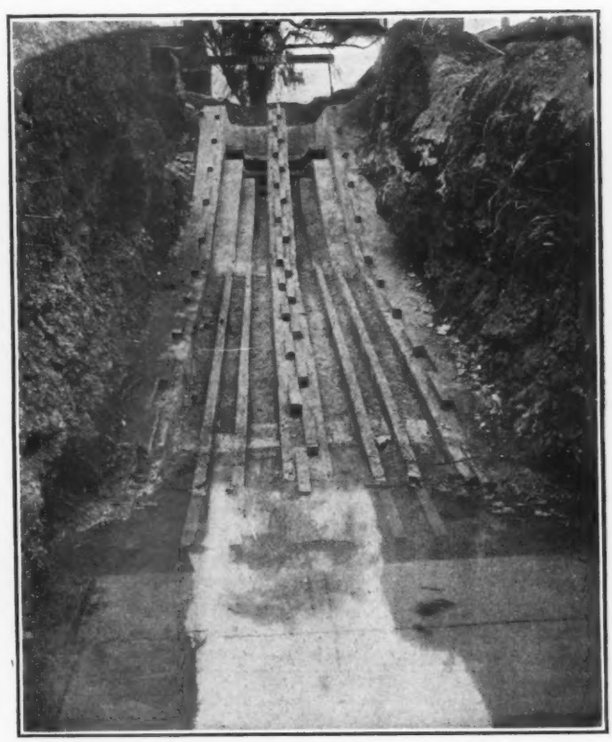


Fig. 9—City Side Entrance from the River for Underground System.

The second floor is laid out for high-tension oil switches as follows: Three present generator switches, three future generator switches, two spare switches, one auxiliary bus switch, one incoming water-power switch, four present underground switches, two future underground switches. The remaining switches are for outgoing overhead feeders. These switches and the bus compartments are arranged in the shape of a horse-shoe, one set being placed along the south wall and the other along the north wall. The switch cells face the outer walls with a 4-ft. aisle between the cells and walls. Instead of the usual brick and slab design these cells are made of concrete, except the floor slabs, which are of the customary slate. This construction weighs much less and consequently saved steel in the floor framing. On the rear side of the cells is the bus structure which contains the main and auxiliary bus. This bus structure, which is original with this plant, consists of separately molded concrete cells set into a space in the barriers, which are of concrete like the switch cells. The switch connections are laid in barriers on the floor in the walkways between the cells and the wall and are covered by a false floor of removable slabs.

As noted in the list of high-tension switches, there are two spare switches (one per row) and an auxiliary bus switch. In case of trouble the spare switch in each set takes the place of a regular switch by means of the auxiliary bus. Through the employment of the two spare switches and the auxiliary bus any overhead feeder can be independently operated from any one turbine.

The benchboard for the generator and field-control system is also on the second floor. It faces the window opening into the turbine-room. This board has an open space over the bench and under the instrument board so that the operator can get a good view of the main floor. The main switchboard, which faces the benchboard, is curved. The control wiring for the switches is in iron conduit embedded in the concrete floor; that for the generator-field circuits runs down the wall into the basement, where it follows the main generator leads.

The third floor contains the electrolytic lightning arresters of all overhead lines. All the switching apparatus and control equipment for the main station and for all the substations were furnished and erected by the General Electric Company.

LOCAL ELECTRIC SERVICE IN THE STATION.

All the lighting and motor-service circuits in each room of the generating plant are controlled from conveniently located slate-lined, steel-panel cabinets. The feeders for these cabinets are taken from the main house-service switchboard on the first floor of the switch house. Alternating current at 110 volts and 220 volts is supplied to these circuits from the house-service lighting transformer. The motor-service requirements are as follows: One 40-hp motor in the roof structure to drive the

24-in. conveyor belt, one 75-hp motor in the coal pocket pit to drive the crusher and the 36-in. belt and two motors for driving the centrifugal fans for the air-blast transformers. Direct current at 500 volts is taken from one of the railway rotaries to operate the crane motors.

MAIN SUBSTATION.

The old central generating plant consisted of three buildings facing Seventh Street and a boiler house in the rear. The first of these buildings, a three-story brick structure with wooden floors and wooden columns, contained a line shaft on the first floor belted to a large Corliss engine in the adjoining building. The same floor had seven small engines driving twenty-eight bi-polar generators on the floor above. The second building was a brick wall, steel-frame structure with a traveling crane. It contained three vertical engines directly connected to railway generators and a similar set for the Edison three-wire system; also the belted Corliss engine previously mentioned. The third building contained three large horizontal cross-compound directly connected units and two small engines, each belted to a pair of generators.

To adapt these buildings for a main substation it was determined to reconstruct the first building, substituting steel for the wooden floors, columns and roof trusses. This building as reconstructed contains high-tension oil switches as follows: Six incoming feeders from the underground system, six 600-volt railway rotary converters, eight 250-volt lighting rotary converters, eight 2300-volt lighting and motor-service transformers, two auxiliary switches, two bus section switches, one arc system switch.

On the second floor is the benchboard, the lighting rotary

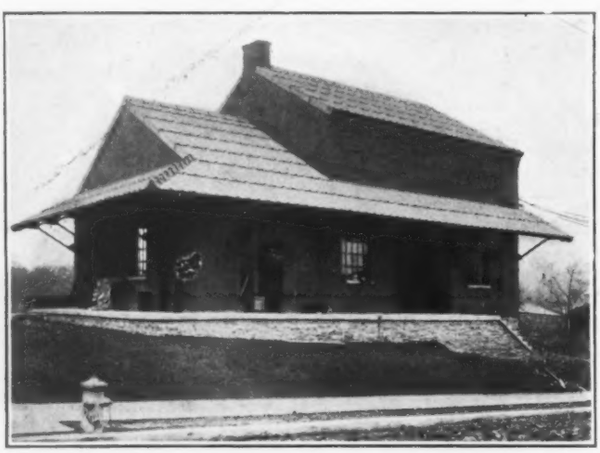


Fig. 10—Stony Creek Substation.

switchboard, the railway rotary switchboard, 2300-volt lighting and motor-service switchboard and twenty-six pairs of interlocking 2300-volt oil switches.

On the third floor are the lightning arresters for the 2300-volt lighting and motor-service feeders and three static dischargers for the three sections of high-tension buses.

The remodeling of this first building was complicated by the necessity of keeping in operation all of the small generators on the second floor. It was also necessary to adopt a column spacing which would interfere as little as possible with the location of the new apparatus and the line-shaft pulleys on the first floor. The new columns were pulled up into place through holes on the second and third floors and the connecting steel floorbeams were set in position a few at a time. To do this each machine on the second floor had to be raised and placed upon blocking equal to the thickness of the future concrete covering over the floorbeams and each machine belt had to be lengthened so that the operation of the plant was hindered in no case. These machines were relocated during the low-load periods of the day. Having installed all the steel structure in this manner, it was necessary only to leave openings in the concrete floor to accommodate the belts until such time as the machines should be entirely removed and the installation of the switches begun.

The old wooden floors were used as construction forms for the concrete floor. As the steel floorbeams were placed 2 in. above the top of the old floor, it was an easy matter to build up the forms and to remove the wooden columns and floorbeams from below on completing the concrete structure. It is interesting to add that no steel contracting company cared to bid upon the erection of this work under the conditions outlined, but it was successfully carried through by the company's men under the direct charge of Mr. C. C. Long, engineer of the Metropolitan Electric Company.

The second building, which contains the traveling crane, was adapted for railway and lighting transformers and rotaries and the street-lighting incandescent and arc system. The present installation consists of four 500-kw railway rotaries and transformers with provision for two additional units; five 500-kw lighting rotaries and transformers with provision for three additional; four 750-kw, 2300-volt transformers with provision for four additional; four 16-kw regulating transformers for series incandescent tungsten lighting, and twelve seventy-five-light mercury-arc rectifiers and transformers, with provision for eight future sets. This building was lengthened two bays, duplicating the original structure, by removing two batteries from the old boiler house.

The load of the old station would not allow the withdrawal of any of the generating apparatus, and hence it was neeessary to install sufficient new machinery with connections to permit the removal of everything from the first building. However, this did not require a large equipment because the small bi-polar units in the first building took up a great deal of space for their output.

In the second building enough room was available to install one lighting transformer and rotary coverter, which, through a temporary switchboard, replaced all bi-polar machinery in the first building. The arc machines were replaced by a lighting transformer temporarily located in the second building. This apparatus could thus be used as soon as the first generating unit in the new plant was ready to furnish energy.

By this arrangement all the machinery was cleared out of the first building, allowing the construction of the switch cells, switchboards, etc., to go forward without any interruption. Then, having installed all of the high-tension switches in the first building, the various transformers and rotaries for the lighting and railway system were gradually placed in the second building to take the place of the directly connected units as fast as they were removed. The third building and the remainder of the boiler house have been rendered available for other purposes.

All the apparatus in this station was furnished by the General Electric Company with the exception of the 600-volt rotaries and transformers, which were furnished by the Westinghouse Electric & Manufacturing Company.

OTHER SUBSTATIONS.

All of the four small substations mentioned in the earlier part of this article are of the general construction typified by the accompanying view of the building at Stony Creek. These structures are built of brick and steel with a roof and platform cover of Bonanza cement tile. All of these substations are furnished with waiting-rooms and freight-handling facilities. Use is also made of a portable substation car.

CONSTRUCTION AND ENGINEERING.

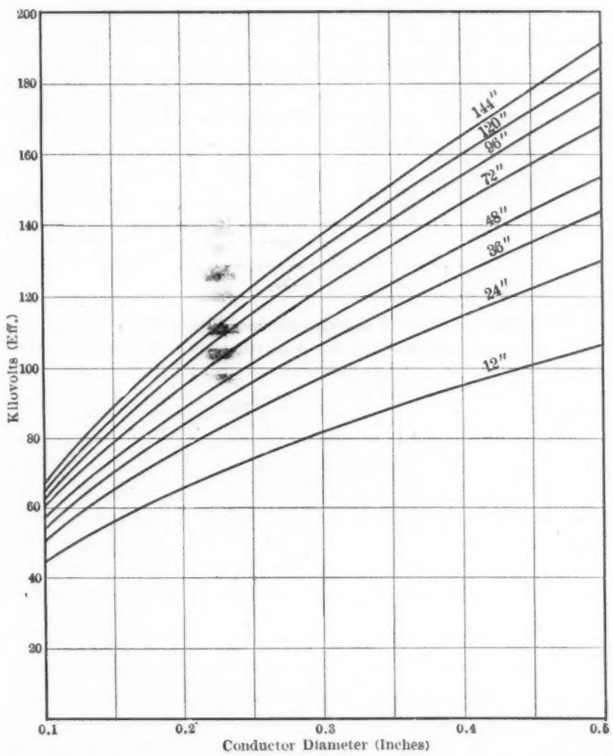
The foundation of the generation station was constructed by Sims & Company, Philadelphia, Pa. The steel framing was fabricated and erected by the Phoenix Iron Company. The reinforced concrete floor and roof were constructed by the Roebling Construction Company and the brick walls by George W. Beard & Company, Reading, Pa.

The entire rehabilitation, together with the electrical, mechanical, structural and architectural designs of all the buildings mentioned, was done by Mr. Walter J. Jones, consulting engineer, New York.

LIMITING VOLTAGES ON TRANSMISSION LINES.

BY ERICH HAUSMANN.

IN transmitting a given amount of electrical energy from the place of its generation to that of utilization, the weight or cross-section of the conductors varies inversely as the square of the operating voltage, allowing the same percentage loss in the line. As the conductors in long-distance transmission circuits constitute perhaps the largest item of investment, it is desirable to employ very high voltages. But raising the voltage increases the investment for transformers, switching apparatus, lightning protection and insulators, as well as augmenting the depreciation and repair charges on these items. Therefore, the economic operating voltage can be determined by expressing each element of cost as a function of the voltage and equating the differential with respect to voltage of the sum of such functions to zero.



Critical Voltages Between Conductors on Three-Phase Circuits.

As the manufacture of high-voltage transformers and auxiliary apparatus progresses the cost per kilowatt will decrease as time goes on, and consequently the economic voltages for proposed energy transmission circuits in the future will exceed those of to-day. There is a limitation, however, to the further increase of voltage on aerial lines, presented by the electric strength of air, for if the voltage is raised beyond a certain critical point an appreciable loss of energy results through the atmosphere, due to the ionization of the air particles. This point coincides with the voltage at which luminosity or corona appears on the conductors.

The voltage corresponding to this partial breakdown of the dielectric depends upon the diameter and spacing of the conductors, but is independent of the conductor material and air velocity, and may be expressed by the well-known relation

$$E_m = Fr \log_e \frac{d}{2r} \text{ kilovolts,} \qquad (1)$$

where E_m is the maximum value of the voltage on a representative single-wire perfectly conducting earth-return circuit (or voltage to neutral), F is the maximum electric strength of air at the conductor surface in kilovolts per inch, r is the radius of the conductors in inches, and d is the interaxial distance between wires expressed in the same units.

Values of the electric strength of air, near smooth cylindrical conductors from 0.05 in. to 0.50 in. in diameter, as determined experimentally by various investigators, notably Ryan,[1] Whitehead[2] and Watson,[3] indicate that the empiric relation between the electric strength of air and conductor diameter may be represented with sufficient accuracy over this range of wire diameters by

$$F = 95.5\ (2r)^{-\frac{1}{8}} \text{ kilovolts per inch} \qquad (2)$$

at 20 deg. C. and 760 mm pressure. Therefore, by substituting this value of F in equation (1) the limiting voltage may be written

$$E_m = 110\ (2r)^{0.8} \log_{10} \frac{d}{2r} \text{ kilovolts} \qquad (3)$$

As an illustration consider the 125-mile Cook Falls-Flint (Mich.) line, at present under construction, on which it is proposed to employ a potential of 135,000 volts between conductors. The wires of this three-phase, 9000-kw transmission line are of copper, 0.325 in. in diameter, and their shortest interaxial distance is 12 ft. The critical voltage at which corona appears on the conductors of this circuit would be 1090 $\sqrt{3}\,E_m$, or

$$\sqrt{3} \cdot 110{,}000\ (0.325)^{0.8} \log_{10} \frac{144}{0.325} = 205{,}150 \text{ volts,}$$

which corresponds to a mean effective value (assuming harmonic wave-shape of e.m.f.) of $\frac{205{,}150}{\sqrt{2}}$ or 145,060 volts between conductors. Consequently, the employment of 135,000 volts as intended will not lead to a corona loss. It must be observed, however, that the electric strength of air, F, at the conductor surface may be lowered by dirt and surface impurities. It is also influenced by temperature and pressure changes.

The critical voltages between conductors on three-phase circuits are shown graphically by the accompanying curves, which were plotted from equation (3). The effective voltage values corresponding to the appearance of corona are given for conductors from No. 10 to No. 0000 B. & S. at various spacings from 1 ft. to 12 ft.

EFFECTS OF THE FORM OF ELECTROMOTIVE FORCE WAVES UPON THE LIFE AND EFFICIENCY OF INCANDESCENT LAMPS.

A recent bulletin of the Engineering Experiment Station of the Pennsylvania State College contains an article by Prof. Charles L. Kinsloe in which are reported the results of a series of experiments relating to the effects of the form of alternating e.m.f. waves upon the life and efficiency of incandescent lamps. The tests were made upon plain carbon, graphitized carbon, tantalum and tungsten lamps. Two groups of lamps, each group composed of a number of each of the four types of lamps just mentioned, were operated until their filaments were broken, or to the "smashing point." The first group was supplied with energy from a generator developing a pressure approximately sinusoidal and the second group was supplied by a pressure having the same effective value as the former, but having a maximum about 12 per cent higher than the sine. At frequent intervals the power consumed by each lamp under test was measured, and at the same time each lamp was photometered, so that a record of the specific consumption of each lamp under both conditions throughout its life was obtained.

The lamps used in the tests were supplied by several of the leading lamp manufacturers of America. The lamps were taken directly from the stock-rooms of these companies, so that the results obtained may be taken as typical of what may be expected from lamps of the best grade now on the American market.

Because of the delicate nature of the filaments of the tungsten lamps these lamps, as well as the tantalum lamps, were

[1] *Trans.* A. I. E. E., v. 23, p. 101, 1904.
[2] *Proc.* A. I. E. E., v. 29, p. 1059, 1910.
[3] Watson, *Electrician*, v. 63, p. 828, 1909; v. 64, p. 707 & 766, 1910.

never removed from the sockets in which they were burning. To make this possible a special testing rack was constructed in a photometer-room and each socket was connected to the circuit through a baby knife-switch so situated that no possible jar could be given to the lamp in cutting it in or out of circuit. By means of these switches all lamps except the one the candle-power of which was to be measured were cut out and each tungsten and tantalum lamp was photometered without removing it from its socket. The candle-power was measured in one direction only, in a horizontal plane, by means of a portable Sharp-Millar photometer. In this way it was possible to perform the entire test without a single lamp being broken by

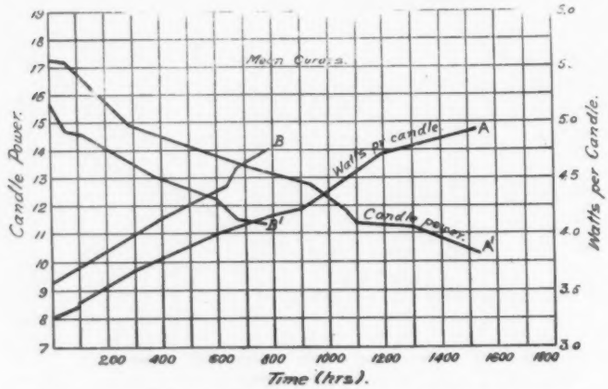


Fig. 1—Candle-Power and Watt Curves of 16-cp Carbon Lamps.

jars or handling. The plain carbon and graphitized lamps were removed from their sockets and photometric measurements were made on a standard photometer bar, while the lamp under test was revolved in a vertical position.

No effort was made to secure absolute constancy in the voltage supplied to the lamps. The tests were intended to show the performance of the lamps under conditions which would be encountered when the lamps were operated on the circuits of the average central station maintaining good commercial regulation. Moreover, no error was introduced from this cause, since both wave-forms were obtained from the same alternator and the two groups of lamps were tested simultaneously. Consequently, any fluctuation in the voltage of one wave was accompanied by a similar fluctuation in the other. The peaked wave was obtained by distorting the original wave by inserting in the circuit a series of reactance coils having highly saturated iron cores. Throughout the test a recording voltmeter was kept in circuit so that any unusual fluctuation would have become apparent at once. Oscillographs of the voltage waves showed that the wave of the generator closely approximated a sine and at an effective value of 110 volts had a maximum of 155 volts. The distorted wave had a maximum of 174 volts with an effective value of 110 volts.

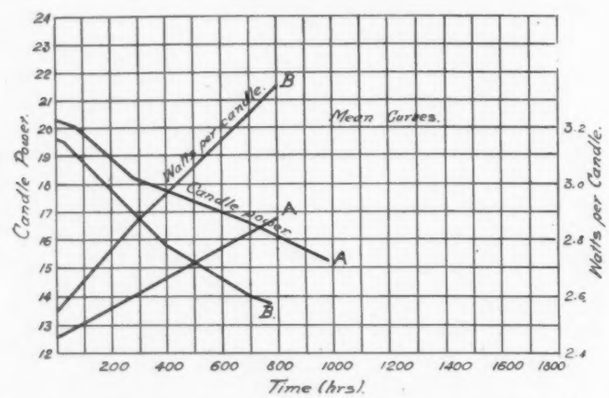


Fig. 2—Candle-Power and Watt Curves of 50-watt Graphitized Filament Lamps.

A marked difference in the performance of the groups of lamps subjected to the two waves was at once observed, and it continued throughout the tests. Moreover, the performance of all lamps of the same type in the same group was quite uniform, and since each group consisted of a large number of lamps, the results are all the more significant. In the curves of Figs. 1, 2, 3 and 4 are shown the mean results of the tests, the curves marked "A" being for lamps subjected to the sine wave and those marked "B" being for lamps subjected to the peaked wave. All of the lamps tested operated much more satisfactorily with the sine wave than with the peaked wave, as indicated in Table I.

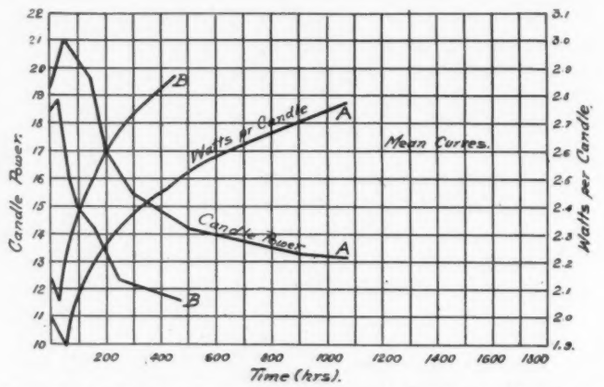


Fig. 3—Candle-Power and Watt Curves of 40-watt Tantalum Lamps.

As shown in Fig. 1, the pure carbon lamps operated with a sine wave gave 17 cp at the start, 13 cp at 800 hours and 10.5 cp at 1500 hours, consuming 3.25 watts per candle at the start, 4.2 watts per candle at 800 hours and 4.9 watts per candle at 1500 hours. With the peaked wave the same type of lamps gave 15.7 cp at the start and 11.3 cp at 800 hours, consuming 3.6 watts per candle at the start and 4.75 watts per candle at 800 hours. The carbon lamps on the sine wave continued in service for more than 1500 hours and it was not until nearly 1000 hours had been reached that the candle-power had fallen by 20 per cent. The lamps on the peaked wave burned out in about 800 hours and before 500 hours the candle-power and efficiency had fallen to values not reached by the lamps of the first group until they had operated for over 1000 hours.

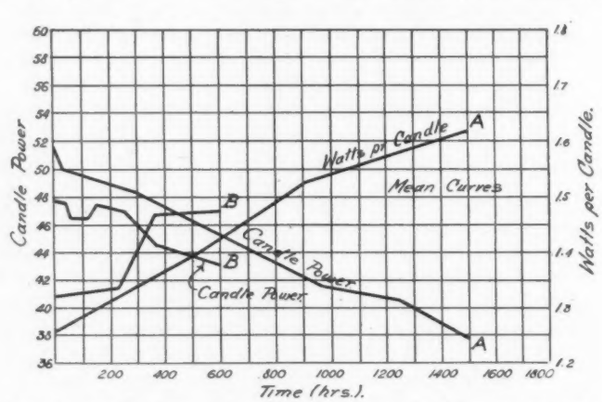


Fig. 4—Candle-Power and Watt Curves of 60-watt Tungsten Lamps.

The performance of 50-watt graphitized-filament lamps is shown by Fig. 2. The candle-power and efficiency of these lamps decreased by 20 per cent after 800 hours on the sine wave and after a little less than 400 hours on the peaked wave. As was the case with the pure carbon lamps, the candle-power of the lamps on the sine wave was higher from the beginning and retained this advantage throughout the test period. A comparison of the performances of pure carbon and graphitized-filament lamps is given in Table II.

Of all the lamps tested the tantalum-filament lamps were most seriously affected by the peaked wave. While the useful life of all tantalum lamps tested was short even on the sine wave, it was found that the life was reduced by about 50 per cent on the peaked wave. The curves for 40-watt tantalum lamps are shown in Fig. 3, while values for 25-watt and 80-watt tantalum lamps are indicated in Table III.

TABLE I.—LIFE OF VARIOUS TYPES OF LAMPS AS AFFECTED BY THE VOLTAGE WAVE SHAPE.

Type of Lamp.	AVERAGE LIFE IN HOURS.	
	Sine Wave.	Peaked Wave.
Carbon	943	860
25-watt tantalum	375	75
40-watt tantalum	1063	474
80-watt tantalum	150	76
25-watt tungsten	913	479
40-watt tungsten	1904	1155
60-watt tungsten	1319	767
100-watt tungsten	1076	734

The average performance of the groups of 60-watt tungsten lamps is indicated in Fig. 4. With a sine wave the lamp gave initially 51 cp, but the light output decreased regularly to 38 cp at 1500 hours; the specific consumption at the start was 1.26 watts per candle and it reached 1.62 at 1500 hours. With the peaked wave the candle-power varied from 48 at the start to 43 at 600 hours; the specific consumption began at 1.32 watts per candle and reached 1.47 watts at 600 hours. The performances of 25-watt, 40-watt, 60-watt and 100-watt tungsten lamps are indicated in Table IV. All of the tungsten lamps, regardless of the wattage, showed a marked similarity in their behavior, the advantage of a sine wave over a peaked wave being very pronounced.

TABLE II.—COMPARATIVE PERFORMANCES OF PURE CARBON AND GRAPHITIZED-FILAMENT LAMPS.

Type of Lamps.	AT BEGINNING.				Average Hours Life.		AT END.			
	Candle-power.		Watts per Candle.				Candle-power.		Watts per Candle.	
	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd
16 c.p. carbon	17.1	15.8	3.25	3.60	1550	800	10.5	11.3	4.9	4.75
50-watt graphitized	20.2	19.7	2.46	2.54	900	760	15.2	13.8	3.04	3.28

TABLE III.—COMPARATIVE PERFORMANCES OF TANTALUM LAMPS.

Rating of Lamps.	AT BEGINNING.				Average Hours Life.		AT END.			
	Candle-power.		Watts per Candle.				Candle-power.		Watts per Candle.	
	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd
25-watt	11.0	11.8	2.32	2.24	375	75	10.0	9.0	2.48	2.50
40-watt	19.2	18.5	2.00	2.13	1063	475	13.1	11.7	2.75	2.85
80-watt	33.2	33.2	2.23	2.18	150	76	35.5	26.5	2.15	2.93

TABLE IV.—COMPARATIVE PERFORMANCE OF TUNGSTEN LAMPS.

Rating of Lamps.	AT BEGINNING.				Average Hours Life.		AT END.			
	Candle-power.		Watts per Candle.				Candle-power.		Watts per Candle.	
	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd	Sine	Peak'd
25-watt	18.1	16.5	1.45	1.38	375	75	17.5	15.9	1.46	1.72
40-watt	33.4	30.7	1.20	1.33	1904	1155	28.1	28.1	1.44	1.46
60-watt	51.0	48.6	1.26	1.32	1319	767	38.0	43.0	1.62	1.47
100-watt	86.0	81.0	1.40	1.40	1076	735	25.0	15.0	4.8	7.50

A microscopic study of the filaments showed that there was a more serious breaking up of the texture of the filaments under the influence of the peaked wave than under the sine wave. The tests in the case of each group of lamps showed that the sine voltage wave was the more efficient in light output for a certain amount of electrical power input and the life of the lamps was much longer. The author expressed the opinion that much unsatisfactory lighting service can be attributed to irregular voltage waves. His investigations will be continued to ascertain if a flat-top voltage wave will be more advantageous than a sine wave.

DATA ON AN ELECTRICAL RESISTANCE FURNACE.

By Albert A. Somerville, Ph. D.

A FURNACE was desired that would easily attain to the temperatures measurable within the limits of the platinum thermometer and always be under control. It was constructed by wrapping a spiral of "Nichrome" ¼-in. ribbon wire around a porcelain cylinder, slipping another porcelain cylinder over this spiral coil of ribbon wire and inclosing this outer cylinder in asbestos or mineral wool such as is used for insulation on large steam pipes.

The inside diameter is 4 cm.; thickness of porcelain tubes, about 1 cm each; length of tubes, 58 cm; thickness of asbestos

Fig. 1—End View of Cylinder Furnace.

wrapping, about 7 cm; total length of wire used, 16 ft.; resistance, cold, 4.4 ohms; resistance at 1000 deg. C., 5.3 ohms. Fig. 1 shows an end view.

The furnace is used in a horizontal position. Both ends of the tubes are open or may be fairly well closed by means of asbestos plugs. Fig. 2 is a portion of a longitudinal view. Temperatures are measured by means of a platinum resistance thermometer, contained in either a porcelain or quartz tube about 15 mm in diameter and 40 cm in length, introduced into one end of the furnace. This thermometer is connected to a

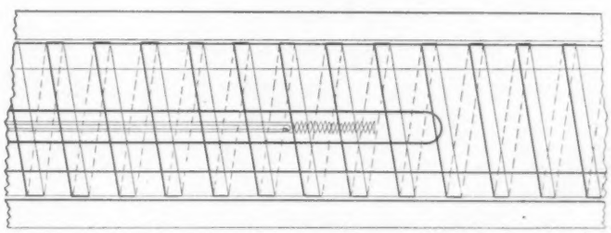


Fig. 2—Longitudinal View of Furnace.

Callendar automatic temperature recorder so that the temperature is known at any time and a complete record of the same is kept during the time of a furnace run.

The Callendar recorder consists essentially of a slide wire bridge. The main leads and dummy leads of the thermometer are placed in series at the opposite ends of this slide wire so

that the lead wires cancel each other's resistance and only the resistance of the bulb of the thermometer is left to be measured on the bridge. This is automatically balanced on the slide wire by the galvanometer arm opening or closing circuits containing electromagnets which move the contact point along the slide wire.

In operating the furnace it is put on a 110-volt, direct-current circuit with resistance in series to control the amount of current, or it is shunted around part of a tin resistance frame.

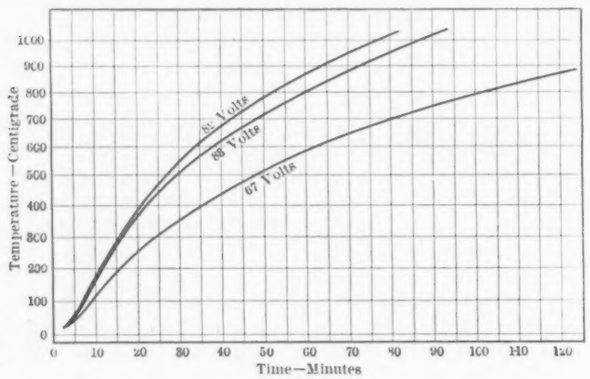


Fig. 3—Temperature Curves.

It has been used entirely for laboratory purposes. The work that has been carried on for two years is the measurement of the resistance of metals and alloys at high temperatures. For this purpose the furnace has served admirably well. In order to show what may be done with it several different curves have been prepared to accompany this article.

Power is turned on, a record is made of the rising temperature until it reaches a maximum, or nearly so, and then power is cut off and a record of the cooling curve is made, all being done by means of the automatic temperature recorder. This is done for various amounts of power and curves are drawn showing the time rate of heating, the power necessary to reach a certain maximum and the time rate of cooling. In Fig. 3 the curves are labeled, showing the voltage used in each case. It is seen from the figure that when pushed the hardest a temperature of 1000 deg. C. was attained in less than one and one-quarter hours. It will also be noticed that the 100-deg. spaces are different distances apart, due to the fact that the resistance and expansion thermometer scales do not coincide.

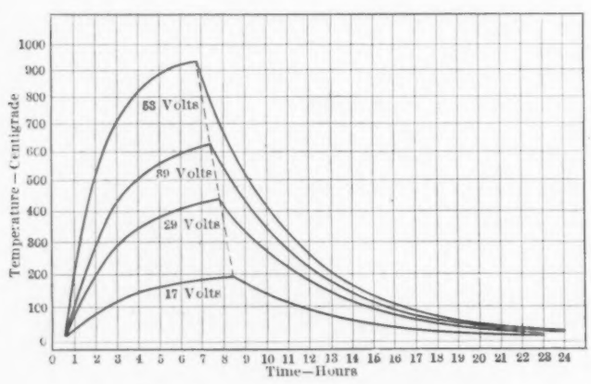


Fig. 4—Heating and Cooling Curves.

The deviation of the expansion from the resistance scale accounts for this lack of uniformity, which is easily calculated.

In Fig. 4 much smaller voltages are used, the time rate of the recorder is changed, and a heating and cooling curve extending over twenty-four hours is drawn. In each case the power is cut off at about the time a maximum is reached, and it is to be noted that in accordance with the laws of radiation a longer time is required to reach a maximum at low temperatures.

The furnace may be heated to any desired temperature, and when the energy supply is made to equal the heat loss it can be held at that exact temperature any desired length of time to within a limit of probably 1 deg. Fig. 5 shows the variation in temperature throughout the length of the furnace for four

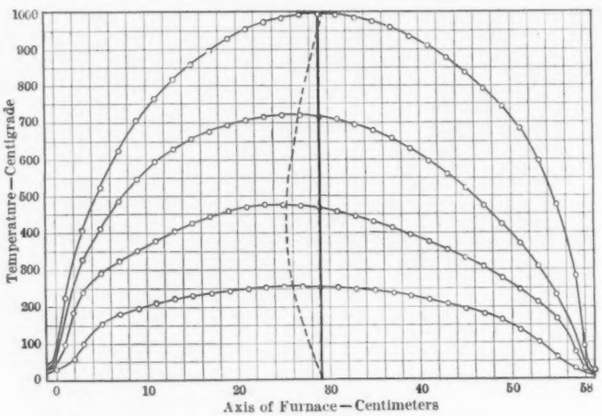


Fig. 5—Curves Showing Variations in Furnace Temperature.

different temperatures. This is obtained by means of a thermocouple, one junction being kept outside the furnace in ice water and the other junction gradually moved through the furnace and a reading of the thermal e.m.f. made for points every 2 cm along the axis of the furnace. It is the intention of the writer to build a furnace soon in which these curves will be very flat near the center of the furnace, or, in other words, the temperature gradient will be very small at that point.

It is to be noticed that the maxima of these curves occur at different points in the furnace. This is due to the thermometer tube being only in one end of the furnace, and at one temperature conduction probably plays a bigger part than radiation, while at higher temperatures this condition is just reversed. By putting a similar thermometer tube in the other end of the furnace it is made symmetrical and the maxima of the curves all occur at the geometrical center of the furnace.

Temperature gradients deduced from Fig. 5 are shown in

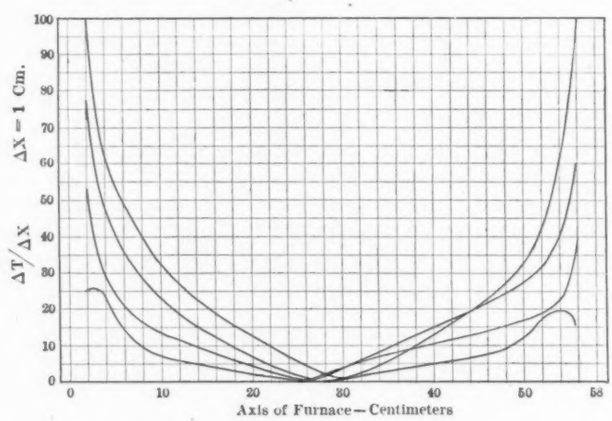


Fig. 6—Temperature Gradients of Resistance Furnace.

Fig. 6. Another method of determining these is to make a thermo-couple having the junctions only 2 cm apart and pass these slowly through the furnace, reading thermal e.m.fs. every 2-cm distance along the axis of the furnace, and the readings give the temperature gradient at once without computing the slope of the actual temperature curves as is done in this case.

IMPREGNATED TELEGRAPH POLES.

In the *Zeitschrift für Forst- und Jagdwesen* Mr. K. Havelik, an engineer, of Brünn, publishes some interesting observations upon the frequent occurrence of the so-called house fungus (*Merulius lacrimans*) on telegraph poles impregnated with sulphate of copper in the Province of Moravia.

The poles, which by reason of their having been attacked by this parasite had to be removed and replaced with others, were characterized by a sort of dado or wainscoting on the surface of the underground portion, such as one sees on all wood which has been injured by this fungus. On digging up the poles there was noticed an unpleasant fungus odor. This fungus was found wherever the poles were subjected to alternations of dryness and dampness, no matter what the character of the soil in which the poles stood. The seed-bearing or germ-bearing parts were almost always on the southeast side of the poles wherever that was shielded from the sunlight. In other cases they were found on that side which was most protected from the direct rays of the sun. The form of these germ-bearing portions is various, depending on the neighborhood and the degree of dampness. If the neighborhood of the pole is sufficiently damp the fertile portions are quite high up and have a bracket-like form. If, however, the earth surrounding the pole is dry, they commence lower down and there is manifested an endeavor to reach the surface of the soil.

The life of poles attacked by the *Merulius lacrimans* is from two to fourteen years; where there is sudden alternation of dampness and dryness the pole rots away sooner. The formation of the *Hyphen* can also be observed. The thread-like germs of this fungus always lie in the lengthwise cracks of the wood and are often quite deep. The more quickly the earth about the pole dries the larger are the threads, but the *Hyphen* itself is seldom to be found here. Where the earth dries more slowly, there are formed either weaker threads or none at all. The *Hyphen* usually branch out all around the pole.

In order to counteract the influence of the house fungus the Austrian Telegraph Department has introduced impregnation with tar, which is regarded as a sure preventive of the *Merulius*.

The Imperial German Postal Department has recently published statistics concerning the life of telegraph poles, as well as their durability.

The average life of the poles was as follows for different impregnating materials: Zinc chloride, twelve years; copper sulphate (blue vitriol), fourteen years; corrosive sublimate, seventeen years; tar oil, twenty-two years.

The annual cost per cubic meter treated and delivered was as follows for the several impregnating materials: Zinc chloride, 4 marks; copper sulphate, 3.50 marks; corrosive sublimate, 3.10 marks; tar oil, 2.80 marks.

These figures show that impregnation with tar oil paid the best, that with corrosive sublimate the next best, and that with zinc chloride the least.

Central Station

Management, Policies and Commercial Methods

NEW CENTRAL-STATION OFFICE BUILDING FOR SPRINGFIELD, MASS.

The United Electric Light Company, of Springfield, Mass., is planning to erect a new office building in the business center of the city to provide room for the display of energy-consuming devices and additional space for the clerical and engineering staff. The company has purchased a parcel of real estate on the west side of Main Street, near the Nayasset Club and the Court House. The building will be three stories in height, 61 ft. wide and 75 ft. deep, and the company will occupy the entire property. A demand has arisen for a modern showroom, which is impracticable in the company's present limited quarters on State Street, and the management also desires to concentrate the clerical force, drafting and meter departments under a single roof. The estimated cost of the new building is about $100,000.

IMPROVING METER READING BY PRIZES AND PENALTIES.

The meter readers of an Illinois electric service company operating in a city of 45,000 are encouraged to increase the efficacy of their work by a system of monthly prizes and penalties, the result of which has made the cost of reading meters less, by careful comparison, for this company than for any of a number of other plants controlled by the same interests. Several prizes are offered to the men, making competition keen.

The reader covering the greatest number of meters during the meter-reading days of each month receives a reward of $1. The reader in whose work the fewest errors are detected also earns an extra dollar. A similar prize is given to the inspector obtaining readings from the largest percentage of the meters in his district. Where the consumer is not at home and access to the meter cannot be obtained the company has its inspectors leave dial cards for the customer to mark in the pointer positions. The third prize mentioned was instituted because the employees in their efforts to win one of the other prizes tended to use the return postals too freely when meters were in inaccessible or inconvenient places.

The company also insists that its meter inspectors shall not give out unauthorized information or former meter readings to customers, nor gossip or converse with them while about the premises for business purposes. Inspectors are permitted to tell the customer his latest reading as recorded, but must not waste time to write it down. The penalty for talking with the customer, except in giving the last dial reading, is the loss of half a cent an hour from the infringer's wage during the following two weeks. All information about matters relating to the customer's consumption and the company's relation with him should come from the office, it is believed, and the readers are instructed to refer all inquirers directly there without discussion.

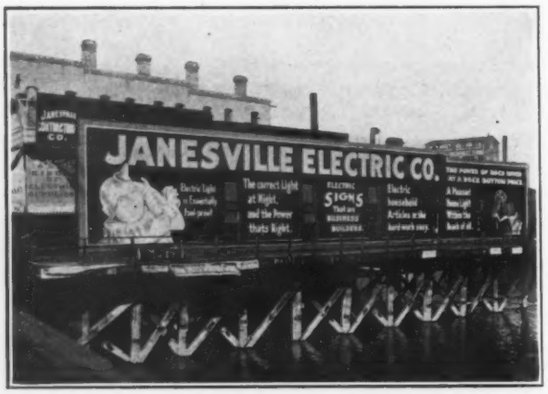
Instead of the present reward feature a penalty was formerly inflicted on those who fell below in the accuracy of their work, territory covered or total number of meters read, but experience showed that this was viewing the situation in a reversed light, as the men became dissatisfied rather than encouraged.

FLAMING-ARC LAMPS IN PUEBLO'S BUSINESS DISTRICT.

The merchants of Pueblo, Col., realizing the necessity of decorative lighting, accepted the plans of the Pueblo & Suburban Traction & Lighting Company to install flaming-arc lamps from Union Depot, on Union Avenue, to the Arkansas River. Since their installation Union Avenue is one of the best-lighted streets in the West. They are of the Adams-Bagnall regenerative type, burning sixty hours with one trimming, on a 110-volt alternating circuit, consuming 7 amp each. The merchants who contributed to the special lighting are very much pleased with it and claim a very large increase in business. With the same interest exercised in the future as in the past few months, Pueblo promises to become one of the best-lighted cities in the West.

CENTRAL-STATION ADVERTISING BY WALL SIGNS.

The central station which uses its wall and sign spaces to effective advertising advantage and changes the display frequently enough to hold interest can gain public attention through this means efficiently and economically. The Janesville (Wis.) Electric Company utilizes the whole river side of its one-story office building as a huge display advertisement for calling attention to the advantages of electric lighting, electric



Central-Station Wall Sign.

signs and electric household devices. As the office building borders the river bank opposite the principal business corner of the city, the display is a prominent one. At night it is lighted by fifty incandescent lamps shielded by an inverted reflecting trough along the top of the building. The sign is renewed at intervals, other subject matter being substituted for that shown, and the display is always kept bright and attractive.

DAYLIGHT AND DARK-DAY CHARTS AT MILWAUKEE.

On the walls of the department to which complaining lighting customers are referred the Milwaukee Electric Railway & Light Company has placed diagrams showing graphically the amount of daylight at different seasons of the year and the proportion of cloudy weather of the current month compared with that of the same month for the preceding year. The accompanying sketch shows the arrangement of the weather chart with its

WEATHER CHART SHOWING COMPARATIVE AMOUNT OF SUNSHINE, PRESENT YEAR AND PREVIOUS YEAR, IN MILWAUKEE.

Per Cent—			Per Cent—	
Clear.	Cloudy.		Clear.	Cloudy.
46.66	53.33	First half	53.33	46.66
73.33	26.66	Second half	46.66	53.33
60.00	40.00	Average	50.00	50.00

black and white sectors giving the percentages of clear and cloudy days. The charts are prepared each month from information furnished by the local observer of the United States Weather Bureau.

Supplementing the weather chart is another diagram showing graphically the proportion of daylight (sunrise to sunset) hours out of the total hours for each of the twelve months. The daylight hours are represented by white blocks and the dark hours by black rectangles. Computed for the latitude of Milwaukee the proportions of daylight hours out of the total hours for each month are as follows: January, 40.5; February, 44.3; March, 49.6; April, 55.3; May, 60; June, 62; July, 61; August, 57; September, 52; October, 46.5; November, 41.5; December, 38.4. This table is, of course, correct for any year in the latitude of Milwaukee.

With the assistance of these diagrams the company's representative is enabled to explain reasonably and convincingly to any customer just why his lighting bill increases during the shortening days of the fall months, and especially during those preliminary months when the earlier approach of darkness is not so noticeable. The comparative-cloudiness chart aids in proving to the consumer why his lighting consumption for a certain period may have increased over that for the same period of the year before, when the cause of this can legitimately be assigned to dark-day conditions. Interiors of downtown business establishments are especially affected by cloudy conditions outside, for the entire lighting equipment may be used throughout the daylight hours without especial attention from the employees or proprietor. The charts referred to assist in demonstrating to the consumer that the variations in his meter readings are actually accountable to natural causes which heretofore he has not considered.

THE DES MOINES PLAN OF METER READING.

Mr. P. B. Sawyer, manager of the Des Moines Electric Company, of Des Moines, Iowa, presented a short paper at the convention of the Illinois State Electric Association at Rock Island Oct. 26 and 27 on the Des Moines plan of meter reading. This plan, which has already been described several times in these columns, consists in reading a portion of the consumers' meters each day, taking the entire city in rotation, thereby keeping one man continually at work reading meters and one man billing. Three years ago the Des Moines Electric Company had 3000 meters and was reading them as near the last day of the month as possible. Under the new plan the city was divided into twenty-five districts, numbered one to twenty-five, to correspond to twenty-five working days, each district being one day's work for one reader. The meters in each district are routed in a reader's loose-leaf meter book and the reader starts out with book No. 1 on the first working day of the month and reads one book on each working day until all the readings are taken. The customers' names as arranged on the addressograph and the meter record book and the customers' ledgers are in the order in which the meter reader's book is routed. On the close of the day following the reading of a district the bills are made out and the gross amount for that district is totaled. The saving in reading meters the first year was approximately $170 and the errors in reading fell to almost nothing. The confusion in the distribution department, from which the readers were drawn under the old arrangement, was eliminated, and in 1908 they were able to get bills collected within fifteen days, which meant several thousand dollars less tied up in the business, as under the old arrangement they were forced to start the readings some months as early as the twenty-second. Errors in billing are also fewer now.

In the discussion Mr. Frank J. Baker, of the North Shore Electric Company, Chicago, said that his company had started this system on trial first in Evanston and had later extended it throughout the entire territory. Mr. E. McDonald, of Lincoln, reported having one man who reads meters and makes out bills. Mr. F. F. Gilchrist, of Chicago, told of a plan adopted by some companies to equalize the summer and winter bills by making the readings represent a shorter period during the winter months than during the summer, gradually working over during the spring and fall. This reduces complaints and tends to increase the use of electricity during the winter months, because consumers will not be so much inclined to economize. In a discussion of the case where the meter reader cannot gain entrance because of absence of the occupant some companies reported

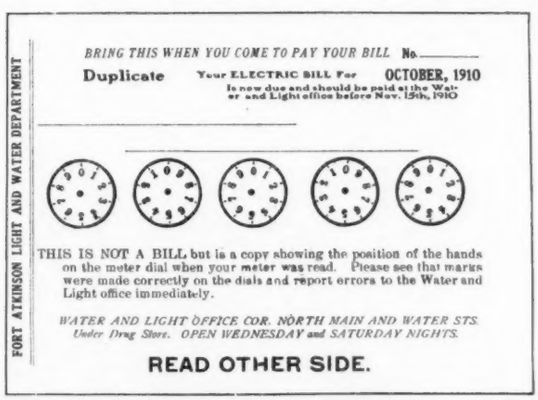
leaving a postal card addressed to the company with the meter dials marked upon it and a request that the consumer mark the position of the meter hands and mail the card to the company. Some companies make it a custom to render a minimum bill when the meter reader cannot gain entrance, but Mr. Baker pointed out that this had a drawback in that when the consumer pays a minimum bill for a certain month's service such a bill ends the question for that month and the consumer objects to paying the large bill which is likely to follow the next month.

Mr. R. S. Wallace, of Peoria, reported having in force a 75-cent minimum bill, but he does not render any bill in case the meter reader cannot get at the meter. The return postal-card scheme spoken of had not proved successful. Mr. N. M. Argabrite, of Belvidere, on the other hand, reported that the postal-card scheme worked very well in his town. The meter reader leaves the cards and nearly all of them come back to the company. Mr. E. W. Smith, of Kewanee, reported having the continuous reading and billing scheme in force, but the bills are not sent until the end of the month. The company renders no bill if the meter is not read. Mr. King, of Lewistown, created considerable laughter with his account of how he sometimes reads the meters from the office by calling up the various ladies in town and asking them to read the meter and report to him over the telephone.

NOTIFYING A CUSTOMER WHEN HIS BILL IS READY.

In places where no prompt-payment discount is offered it is frequently unsatisfactory to allow the original bills to be left in the customers' hands, as they are frequently lost or mislaid and much unnecessary clerical work is entailed on the bookkeeper when the customer finally appears for settlement. The municipal plant in Fort Atkinson, Wis., operating in a town of 5000, employs a duplicate form of notifying the customer that his bill is awaiting him at the office, at the same time presenting to him a record of the meter reading, that he may check this with the position of the dials at the time the reading was made.

The two forms shown herewith are used, the consumer's name and address being entered on the first blank lines and the meter-pointer position on the dials by the meter reader as he makes his rounds. The two forms are bound as alternate leaves into tablet form, so that carbon paper may be used to make the duplicate copy. The original, or "bill," form the meter reader retains, handing the duplicate, or "notification," to the customer at his home at the time of the reading. This duplicate is presented


FORT ATKINSON LIGHT AND WATER DEPARTMENT

BRING THIS WHEN YOU COME TO PAY YOUR BILL No._____

Duplicate Your ELECTRIC BILL For **OCTOBER, 1910**
Is now due and should be paid at the Water and Light office before Nov. 15th, 1910

THIS IS NOT A BILL but is a copy showing the position of the hands on the meter dial when your meter was read. Please see that marks were made correctly on the dials and report errors to the Water and Light office immediately.

WATER AND LIGHT OFFICE COR. NORTH MAIN AND WATER STS. Under Drug Store. OPEN WEDNESDAY and SATURDAY NIGHTS.

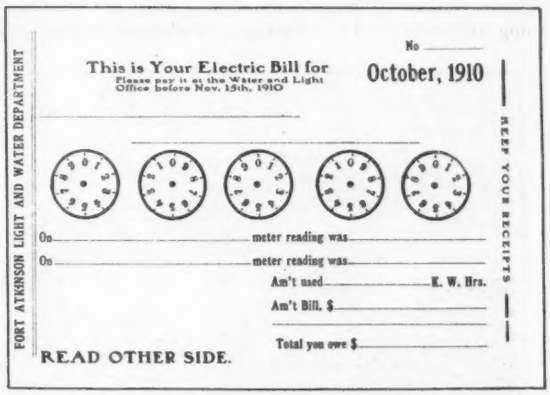
READ OTHER SIDE.

Notification Duplicate Filled in and Handed to Customer by Reader.

simply as a notification that the bill is due at the office. To satisfy himself that the meter was read correctly the consumer can at once compare the marked dial positions with the pointers on his register and is usually pleased at this privilege of checking the reading. As soon as practicable he calls at the office, and, upon learning and paying the amount which has been figured from the reading before taken, he receives the original bill, now receipted.

As a precaution against misunderstanding of the duplicate "notification" this duplicate is canceled if brought in, in order that the consumer shall not afterward suspect or fear he has paid the same bill twice. The backs of both the original and duplicate forms contain a list of "Dont's for Electric Consumers," which are simply popularly written paragraphs of explanation and advice about the service.

The fact that the meter reader retains the "original" and re-


FORT ATKINSON LIGHT AND WATER DEPARTMENT

No. _____

This is Your Electric Bill for **October, 1910**
Please pay it at the Water and Light Office before Nov. 15th, 1910

KEEP YOUR RECEIPTS

On_____ meter reading was_____

On_____ meter reading was_____

Am't used_____ K. W. Hrs.

Am't Bill, $_____

Total you owe $_____

READ OTHER SIDE.

Original Bill, Surrendered to Customer When Receipted.

turns it to the office allows this bill to be kept under attention and carried along until paid without danger of losing a record of the pending amount. When the customer calls it is ready for him and the annoyance of making out duplicates is avoided. The stub from which the perforated "original" is torn is kept for office record of the bill paid. If the bill remains unpaid and a second notice must be sent, an altogether different form is used, the original bill being always retained in the office until the account is settled.

ELECTRIC SHOWS IN SMALL CITIES.

Mr. J. E. Johnson, general superintendent of the Danville (Ill.) Railway & Light Company, gave a paper on electric shows in small cities before the Illinois State Electric Association at Rock Island, Oct. 26 and 27. Last summer his company rented for this purpose a large room in the busiest street in the town, 50 ft. wide x 150 ft. long, with the usual two large show windows in front. The company made a proposition to everybody who handled anything relating to the use of gas or electricity that it would pay the rent of the room and furnish the general decorations and supply free energy. The decorations were made a prominent feature, artificial foliage being used to obtain a garden effect. The company's men built some wooden columns about 10 ft. high with rows of 16-cp lamps on each of the four corners, and wooden crosses at the top equipped with high-candle-power lamps. The columns were coated with white water paint to give a suggestion of white stone and the lamps equipped with green and white paper shades of the ordinary kind made to resemble the petals of flowers.

It cost only a few dollars to paper the background of the two show windows, one with a paper suitable for a dining-room and the other with glazed paper imitating tile for a kitchen. In the windows were put attractive furniture borrowed from merchants, who were glad to lend anything provided a small card was displayed telling the name of the merchant loaning it. One window was called an electric dining-room. A dining table was set for breakfast with the customary china, silver and glassware. On it was a coffee percolator, cereal cooker, toaster and boiler to indicate that the entire breakfast could be prepared with electricity. On the sideboard were put a chafing dish and a tea kettle. The other window was fitted up as a model gas kitchen. Inside, in addition to a complete line of gas appliances, was an exhibition of every kind of electric heating appliance that the company could obtain. There was a new electric

vehicle and a mercury-rectifier vehicle-charging set, which was run continuously with the case off in order that the peculiar light should attract attention. There was a compressed-air water-pressure system operated automatically with a motor, a coffee roaster, coffee grinder and meat chopper, all of which were driven by motors; a few vacuum cleaners, electric washing machines, an electrically driven "Simplex" ironing machine, some soldering irons, electric drills, electric irons, fan motors, vibrators and curling irons. The supply men in addition to the other appliances they handled exhibited quite a line of attractive fixtures. The Burrows company had several motor-operated adding machines and the National Cash Register Company an electrically operated register. One of the sewing-machine companies was glad to furnish machines which were fitted up with motors, and a girl was on hand to demonstrate both. A couple of boys toasting bread and popping corn attracted attention.

An exhibition of the Tel-Electric piano by a local piano firm furnished some music. The work that could be done with vacuum cleaners and electric irons interested many people. The local telephone company also was glad to participate and install telephones in every booth in the room, as well as a public telephone booth and an intercommunicating switchboard connected to the company's main central office.

This exhibition was run for eight afternoons and evenings. The greater part of the adult population of the town of 35,000 visited it. To attract the attention of the passersby an arc headlight was used as a searchlight on the roof. In front of the building was a waving-flag sign and a couple of electrolier posts, which were a new thing at that time. All the company's solicitors and as many of the office force as could be spared were always on duty. The lamp-post in front, they believed, helped to create an interest in that kind of lighting. A couple of dark booths were fitted up to show the difference between good and bad glass shades, and the difference between light obtained from dirty lamps with dirty shades and that obtained from clean lamps with clean shades. The public seemed to believe that the exhibition was an expensive one and gave the company credit for being public-spirited and progressive. Merchants appreciated it because it brought a great many people downtown that week.

It is Mr. Johnson's opinion that such an exhibition will be a profitable investment in almost any town of several thousand inhabitants or more, and that the returns will exceed those obtained from an equal expenditure on solicitation or advertising in the ordinary channels. He hardly believes it would pay in most towns to repeat such an exhibition every year, but he believes that it could be given profitably once every two or three years as new appliances are developed and put on the market.

In the discussion Mr. E. W. Smith, of Kewanee, said his company had successfully experimented along the same line two years ago. Mr. A. G. Mosier told of an electric show held in a park building on the street-railway line a short distance out of Chillicothe, Ohio. This show cost $250 and increased the street-railway receipts $175 above the ordinary run of business on that line. Mr. Theodore Bass, of Farmington, Ill., a town of 3000 population, said that he started day service March 1, 1910. In order to assist in building up a day load a "house electrical" was devised, which the supply men assisted in equipping. A room 50 ft. x 90 ft. was rented and small rooms were arranged along one side of this large room with an aisle along the other side. The company placed 300 irons soon after the show and has been selling devices of various kinds ever since.

Mr. T. W. Gregory, of East St. Louis, said that his company had never attempted an electric show, but had made it a point to exhibit at several pure-food shows, etc., in its territory. Mr. John G. Learned, of Chicago, contract agent of the North Shore Electric Company, said that his company had rented a tent at a county fair in the North Shore territory and exhibited household and family appliances. Mr. M. G. Linn, of Bloomington, reported having had an electric show last spring. Mr. Bell, of Granite City, said that while he had never conducted an electric show, his company had made use of small opportunities at domestic-science meetings, farmers' institutes, etc.

Wiring and Illumination

INEXPENSIVE TUNGSTEN STANDARDS FOR FORT ATKINSON, WIS.

For lighting the downtown business portion of Fort Atkinson, Wis., the local lighting commission is arranging to install forty three-lamp curb posts, each carrying three 60-watt tungsten lamps inclosed in 10-in. Alba globes. The posts will be erected at 90-ft. intervals on each side of the street and opposite one another. A feature of these standards, which were constructed by the commission's employees after designs by Mr. H. G. D. Nutting, the manager of the local plant, has been their low cost of construction and installation. The bare standards cost about $6 each to make, and equipped complete with wiring and globes cost $9. As about $700 will be expended

Tungsten Lamp Post at Fort Atkinson, Wis.

in laying the underground wires in lead tubing, the forty-post installation will represent an outlay of less than $1,100, or $26.50 a post complete. The vertical standard is made up of 4-in and 2½-in. wrought-iron pipe and the cross-arm is of 1.25-in. pipe. Special end and top fittings have been designed and cast and the globes will be held by inclosing yokes which fasten them securely, at the same time preventing the entry of water to the lamp sockets within. The lead conduit is inserted 5 in. or 6 in. into the base of the standard, one line going through a fuse block, to which access is secured by sliding up the base sleeve, which is not a structural part of the post. Each post weighs about 150 lb.

PREMIUMS FOR CONTRACTORS WHO WIRE OLD HOUSES.

A central-station manager in a medium-sized city who believes that the electrical contractors of his town are his best electric light solicitors encourages them to improve the dull winter season by wiring old houses and offers a premium of $3 for each house on the electric company's lines thus wired. As, of course, the cost of wiring such completed houses cannot be computed under a blanket table, the contractor is not limited to the amount he may charge for the job, and in addition receives the $3 reward from the electric company. The offer is one that encourages some initiative on the contractor's part and has resulted very profitably for the electric company, which is content to transfer its soliciting fee from its own office staff to the man actually securing the new connection.

SOME TESTS ON SPLICES IN GALVANIZED-IRON WIRE.

BY C. T. RASHMAN.

Galvanized-iron wire is used for guying and in some localities for telephone circuits. The joints or splices between adjacent ends are usually made by twisting the ends one upon the other and are not ordinarily soldered. Several types of splices are in use, and to ascertain which is best a series of tensile tests was made on all of the commonly used types under the writer's directions. The desideratum was to find out which type of splice

Fig. 1—An Unsatisfactory Splice.

behaved best when subjected to tension and if possible to determine a style of splice that would develop a tensile strength equal to that of the wire of which it is made.

Commercial wire cut from coils in the stockroom of a telephone company was used. It was probably of the grade known as "best best" or BB, although it was not possible to ascertain accurately what the grade was. The samples were tested in an Olsen testing machine.

First, a length of No. 12 (B. W. G.) wire was stressed to failure and was found to break at 475 lb. This value is the average of several. Then splices of the typical forms of Figs. 1, 2 and 4 were made of No. 12 wire, and tested to destruction. None of the three was found to be as strong as the wire of which it was made. Finally, after some trials, splices like that

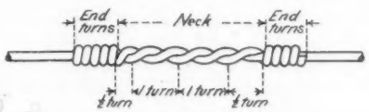


Fig. 2—Splice That Failed.

shown in Fig. 5 were formed and it was found that the wire would break before a splice of this type failed.

Splices like that shown in Fig. 1 are made by clamping the two wire ends to be joined in a pair of connectors—the tool used by linemen for holding wires in correct relation while they are being spliced—and, with a pair of pliers, forming the wire into close end-turns around the wire bodies. What is meant by "end-turns" can best be explained by the illustration Fig. 2, whereon the end-turns of a certain splice are indicated. The neck—the portion of the splice between the end-turns in the type of splice shown in Fig. 1—is not twisted. This type of splice was largely used at one time, but does not appear to be used now. When a splice like that in Fig. 1 is subjected to tension the end-turns first pull together along the main wires and finally assume the position indicated in Fig. 3. Then, as the stress is continued, the end-turns gradually upwrap and the two spliced wires usu-

Fig. 3—Appearance of Splice While Untwisting.

ally pull entirely apart. In some cases one of the wires will break before the end-turns entirely untwist. The break often occurs at a point where the wire is nicked in making the splice. Increasing the number of end-turns increases the load at which the joint will start to yield, but in no case could a joint having a reasonable number of end-turns of this type be made to develop the full strength of the wire of which it was made without yielding excessively.

In Fig. 4 a splice is shown which is frequently called in books the American Telephone joint. It has a short neck containing one turn and a number of end-turns varying with the maker of the splice. The idea appears to be prevalent among linemen that the strength of a splice is dependent almost wholly on the number of end-turns it has and that the number of turns in the neck is of little consequence. It was shown by tests that this idea is erroneous. As tension is applied to a joint like that of Fig. 4 it will untwist entirely, or often, partially untwisting one of the wires, will break at a load considerably less than one equivalent to the full strength of the wire.

It having been shown definitely that increasing the number of end turns of a splice does not increase its yielding point to any great extent, tests were made to ascertain the effect of increasing the number of turns in the neck. Several sample splices were made, each having but two end-turns, but the number of turns in the neck was made different in each case. Each of these splices was tested to failure. The results of the test were as follows:

Turns in Neck.	Failure Tension, Lb.	Cause.
3	230	Splice slipped.
4	230	" "
5	475	Wire broke outside of splice.
6	475	" " " " "

It is apparent from the above observations that if a joint has five turns in the neck the full strength of the wire composing it will be developed. The joints for the above-recorded tests were all made from No. 12 wire having a breaking strength of 475 lb. The results in the table are averages of several.

Fig. 5 shows a joint having five turns in the neck, that is as strong as the wire of which it is made. When subjected to tension such a joint will at first yield slightly until it is "set," but as the load on it increases there is little yielding and finally one

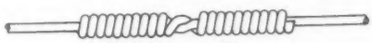


Fig. 4—A Common Type of Splice.

of the wires will break outside of the joint at about its normal breaking point. The length of neck of such a joint is determined by the size of the wire composing it. In each case the neck length should be such that it will just safely contain five turns. If the turns be made too short the wires will be "burned" in twisting the splice and if the turns be made too long their power of resistance will not be a maximum. It was found that proper neck lengths to contain five turns safely for different gages of wire are about as follows: No. 14 wire, 3½ in.; No. 12 wire, 3¾ in.; No. 10 wire, 4 in.; No. 8 wire, 6 in., and No. 6 wire, 7 in. After the tests were completed on splices made from No. 12 wire, more were made on the other sizes given above and it was found that for each size the number of turns in the neck of a safe joint should be five. Although five end-turns are shown in the illustration of the typical safe joint, Fig. 5, the tests indicated that two are ample. A joint

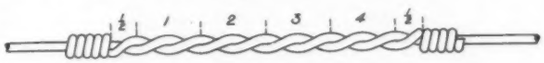


Fig. 5—A Satisfactory Splice.

having five end-turns has a better appearance than one having two, hence five is suggested as a standard number.

A few soldered joints were tested and it was found that, at least for the wire sizes used, almost any joint if soldered would develop a strength greater than that of the wires composing it. Joints of No. 12 and No. 14 wire made with one twist in the neck and one end-turn at each end would, when subjected to tension, remain intact, while the wire from which the joints were formed would break outside of the joint.

Summarizing, the results of the tests may be stated as follows: (1) End-turns do not have much holding power. (2) Most of the holding power of a joint is due to the turns in the neck. (3) A joint having five properly made turns in its neck will be as strong as the wire from which it is made and will yield but little when stressed.

RECENT TELEPHONE PATENTS.

IMPROVEMENT FOR AUTOMATIC EXCHANGES.

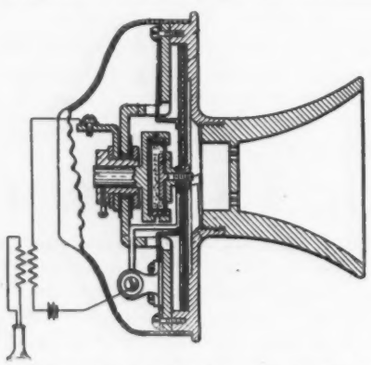
In the modern automatic exchange of the Strowger type the number of switching devices required for a given number of lines has been made relatively small by the use of master switches and preselectors. Through the agency of these, large groups of lines need be associated with a number of switches no greater than the maximum number of coexistent conversations from that group.

The invention of Mr. B. Kugelmann, of Bad Kissengen, Germany, provides for the accomplishment of the same results without the use of a master switch. In his system the lines act upon the preselectors to accomplish the selection of a non-busy first selector.

NEW APPARATUS.

As a means of improving the sensitiveness of a receiver Mr. G. Babcock, of Rochester, N. Y., has introduced a diaphragm consisting of two disks. Both of these are disked and their convex surfaces are opposed to each other and the whole flattened out by driving home the ear cap. The receiver is of the watch-case type and its shell is of steel permanently magnetized with a pole at the rim and one at the center of the back wall.

The cut shows a section of a transmitter which is the joint invention of Messrs. O. M. Leich and N. Pedersen, of Genoa,



Leich-Pedersen Telephone Transmitter.

Ill., their patent being assigned to the Cracraft-Leich Electric Company. The novelty lies in a mica disk at the rear of the diaphragm and in the peculiar L-shaped damping springs which pass through slits in the bridge and bear upon the mica disk.

Mr. A. H. Weiss, of Chicago, has patented a drop especially designed to permit the ready removal of the coil. Both the armature and the shutter trip rod are mounted upon the same pivot. The trip rod is of sheet metal and is so cut that flat spring fingers project from it and bear upon the top face of the armature. This pressure holds the armature and rod normally at right angles. A slight outward pressure upon the armature will overcome the pressure and bring the armature and rod in the same plane, exposing the drop-coil end for withdrawal. The Kellogg Switchboard & Supply Company has obtained this patent by assignment.

A patent granted to Annie K. Cann describes a paper antiseptic device. The paper is cut like the figure 8. The bottom perforation is covered by a thin membrane pasted on. The upper loop is cut at the top point. A fold is then made upon the mid line, so that the slit loop will serve as a clamp to hold the membrane across the mouthpiece of a transmitter.

Messrs. W. C. Thomas and A. C. Hewitt, of Philadelphia, have jointly patented a receiver support. This has the usual adjustments and is carried upon a bracket clamped to the upright of a desk stand. The arm swings about a horizontal pin and when thrown upward until the center of gravity of the receiver crosses over the pin it comes to rest against a stop, being held by the weight of the receiver. As the arm is being thus raised a dog secured to it engages the hook switch of the desk stand and depresses it.

WIRELESS RECEIVING CIRCUIT.

A circuit for wireless telephony is patented by Mr. O. Rochefort, of Paris, France. The ends of the resonator device, with which the antenna is connected, are connected, respectively, to the ends of a two-branch circuit. Each of these branches contains two electrolytic cells, those in one branch being oppositely poled from the other. A source of potential is connected across from one branch to the other in each and between the electrolytic cells of that branch. A telephone instrument is inserted in this cross as a shunt circuit. The opposite poling of the cells, taken together with the polarizing effect of the source of potential, permits of an undulating or alternating current being set up through the shunt circuit containing the telephone.

LOUD-SPEAKING DEVICE.

The patent granted to Mr. J. W. Atlee, of Riverton, N. J., describes a loud-speaking attachment for telephones. The megaphone is shaped so that its mouth points in a direction parallel to the axis of the transmitter mouthpiece, so that although the sound passage is long the over-all dimensions are not great. This megaphone is carried upon a convenient bracket and its small or mouthpiece end terminates in a horizontal seat suitable for supporting the ordinary hand receiver. A cushion on the end of the megaphone registers with the receiver sound passage and insures that all sound emitted enters the megaphone. Such a device obviates the necessity of holding the receiver to the ear while holding the line and also permits of conversation with both hands free.

PRIVATE-BRANCH INTERCOMMUNICATING SYSTEMS.

Two patents for improvements in intercommunicating private-branch exchange systems have recently been issued, both being assigned to the Western Electric Company. This is the type of system providing exchange lines and intercommunicating lines with full switching means at each station. One of the patents was issued to Mr. J. L. McQuarrie, of Oak Park, Ill. It provides for the holding of an exchange line while the answering instrument is switched off to communicate with some other station. It also provides for the release of the holding circuits as soon as any station comes back on the exchange line.

The second patent was that of Mr. H. D. Currier, of Chicago, which provides for a series use of transmitter and receiver upon local calls, but the use of the standard induction-coil circuit for exchange calls. All of the induction coils are associated with the exchange lines, one for each such line. Furthermore, when used for local or intercommunicating calls the receiver is shunted so that the transmitter will receive its full current, the shunt being inductive, though receiver efficiency is unimpaired.

MISCELLANEOUS ATTACHMENTS.

An antiseptic device for use with transmitters has been invented jointly by Messrs. A. P. Levi, H. Schlessinger and M. Schlessinger, all of San Francisco. The device comprises a sheet-metal ring with in-turned flanges which is adapted to slide over the outside of a transmitter mouthpiece. The flanges are of such diameter as to contact with the outer wall of the mouthpiece all around, while the body of the ring follows the general contour of the mouthpiece. The space between the mouthpiece ring and flanges is filled with absorbent material soaked in antiseptic and small perforations are made through the wall of the mouthpiece to permit antiseptic fumes to pass into the sound passage.

An invention of Mr. C. A. Barnes, Sr., of Greenfield, Ind., covers a handle for the ordinary hand-telephone receiver. This handle is formed of sheet metal and consists of two arms connected by a bow. The bow is of such size and diameter as to fit conveniently the shank of an ordinary hand telephone. The arms are then brought together, clamping the bow tightly upon the receiver, the lower end of one arm locking behind the upturned end of the other arm. The device affords a sort of handle at right angles to the axis of the receiver.

LETTER TO THE EDITOR.

The Light of the Firefly.

To the Editor of Electrical World:

SIR:—Your editorials and the notes by Drs. Ives, Coblentz and Thomson in regard to the light of the firefly have been of great interest to me. In connection with Prof. J. H. Kastle, of the University of Virginia, I have had occasion during the past two summers to make a study of this subject of the light of the firefly, with special reference to the chemical problems involved. A great deal of chemical work has been done upon it, much of it of great interest, and perhaps some of the points brought out may be of interest to your readers.

So far as now known, two constant chemical factors are necessary for the production of light by a living organism—water and oxygen. The third necessary factor, the substance oxidized, may be, and probably is, variable. All attempts definitely to isolate and analyze this third substance have so far failed, although it has variously been called "noctilucin," "luciferin" and "photogen" by different observers, and has been assumed to be either a fat or an albuminous body. The luminous organ of the firefly consists of two layers of material under the outer transparent chitin. The inner layer consists mainly of guanin (a compound similar to uric acid) and probably serves as a reflector; this guanin reflector appears to have been found also among the photogenic fish and cephalopods. The outer layer consists of a mass of cells, apparently nucleated, and normally of a pale yellow color. Both layers are penetrated by innumerable minute tracheæ, which unite in the interior of the insect to form larger passages and run together in the outer layer of yellow cells, forming a network somewhat resembling the finer veining of a leaf. It is practically certain that in life these passages are filled with air, and it seems probable that the photogenic process is accompanied by the evolution of carbon dioxide and the consumption of the oxygen of the air.

The effect of chemical reagents on the tissue of the photogenic organs is very striking, but cannot be entered into here. A joint paper of Dr. Kastle and myself will appear shortly in the *American Journal of Physiology*, and those interested are referred to that. One interesting point may, however, be cited. The luminous tissue dried over sulphuric acid in an atmosphere of hydrogen retains for over a year its power to glow when moistened with water in the presence of oxygen. If commercial hydrogen-peroxide solution be used in place of water the light is more intense; its spectrum is of very limited range, extending only from the orange to the yellow-green of the visible spectrum. Max Trautz has published in the *Zeitschrift für Physikalische Chemie* an exhaustive article on Chemiluminescence, in which he records the results of a large number of experiments with mixtures and compounds alleged to produce light, and one of these (pyrogallol oxidized by strong hydrogen peroxide in the presence of formaldehyde) he found produced a spectrum which covers about the same spectral area as that of the firefly.

A brief general review of this subject, by myself, may be found in the *Popular Science Monthly* for August, 1910.

Washington, D. C. F. ALEX. MCDERMOTT.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Squirrel-Cage Induction Motors with High-Resistance Secondaries.—R. E. HELLMUND.—An article on the various applications of squirrel-cage induction motors with high-resistance secondaries. Motors of this type are employed in three distinct conditions of service: Firstly, in operation in combination with a flywheel, driving machinery which is subject to heavy loads of short duration, such as punch presses, etc.; secondly, for driving machines which require comparatively large starting torque, either on account of large friction of rest or on account of large masses to be accelerated; thirdly, for application where a large starting current is objectionable. These different applications are discussed separately at some length with the aid of diagrams.—*Elec. Journal*, November.

Radial Ventilation Slits.—T. HOOCK.—An article on the effectiveness of radial ventilation slits in electrical machines. The results of tests are given of a certain machine which show that during a certain time the machine could be loaded with a greater load when the ventilation slips were closed than when they were open. This was due to the fact that in this case the hot air from the interior of the armature cannot get out to the frame, but heats the field coils and pole surfaces to a higher temperature. This is, of course, detrimental.—*Elek. u. Masch.* (Vienna), Oct. 23.

Vector Diagram of Three-Phase Induction Machines.—R. RÜDENBERG.—In constructing the well-known circular diagram for three-phase induction machines from the vector diagrams of the stator and rotor currents the difficulty is encountered that two diagrams relating to different frequencies must be combined. The author proves that this may be done by letting the time vector rotate with different velocities in both diagrams. The author applies the diagram to the operation of an induction machine below and above synchronism and corrects a mistake formerly made by others in the diagram of the machine running above synchronism.—*Elek. Zeit.*, Oct. 27.

Repulsion Motor.—L. BERGER.—A theoretical article illustrated by diagrams. The author gives the theory of Rusch of the single-phase repulsion motor. The diagram of the motor is first given, neglecting the stray fluxes and the ohmic losses, and it is then modified so as to take these factors into account. He then investigates the influence of the coils short-circuited by the brushes at starting and calculates the torque.—*La Lumière Elec.*, Oct. 22.

Lamps and Lighting.

Surface Brightness.—J. S. DOW AND V. H. MACKINNEY.—A paper read before the Optical Society in London describing a

Fig. 1—Interior of Surface-Brightness Photometer.

new lumeter surface-brightness photometer. The idea of the instrument is to enable an observer to measure the surface brightness of any surface by comparing it directly with a standard illuminated white one. The manner in which this is done is shown in Fig. 1. The observer looks directly at an

illuminated screen and sees through an aperture therein the illuminated surface to be studied, for example, a picture or some object in a shop window. This screen is illuminated by an opal glass plate. Behind this is a small metallic-filament lamp at a sufficient distance to render the screen of uniform brilliancy. In the illustration the screen, with its circular aperture, has been taken out and is seen resting against the box. The sector-shaped opal surface can also be noted. The screen has been made by depositing a matt-white precipitate on thin glass and then scraping away a central disk. The screen is subsequently covered by a thin glass plate, which is bound in position. The actual white surface is thus preserved from air and moisture, and the glass cover can be handled with safety and easily cleaned. The position of the screen is such that no direct reflection from this surface into the eyepiece is possible.

Fig. 2—Diagram Showing Method of Altering Illumination.

The method of altering the illumination is somewhat unusual. The screen, *S* (Fig. 2), is covered by an opaque diaphragm which allows only a sector to be exposed. In front of this evenly illuminated sector two corresponding opaque screens, attached to levers *A* and *B*, can be made to pass. As the screen *A* is moved in front of the sector in area, its intensity as a light source will be uniformly diminished from, say, 1 to 0.1. The remaining intensity 0.1 is derived from the part of the surface still visible through the ring *R*. The area of *R* is arranged to be exactly one-tenth of the total area of the bright sector. The lever attached to *A*, therefore, travels on an equally divided circular scale with nine divisions from 1 to 0.1. Having drawn across the lever *A*, the illumination may be still further reduced by also bringing over the lever *B*. This exactly resembles *A*, with the exception that there is no ring cut out. Thereby the illuminated portion of the opal plate still left exposed is gradually cut off and the illumination is uniformly reduced from 0.1 to 0. The lever *B* travels on a second scale immediately above that of *A* graduated from 0.1 to 0. Before using the apparatus a person adjusts the position of the glow lamp illuminating the opal plate until the brightness of the white surface *S* (as compared with another similar white surface illuminated by a standard lamp at a specified distance) is, say, exactly 1 ft.-candle. He then fixes the lamp in this position and regards the scales as registering in ft.-candles. By means of the device already described one can measure values from under 0.01 to 1.0 ft.-candle. It is also proposed to equip the instrument with two dark glasses, each absorbing one-tenth of the light passing through them, in order to increase the range of the instrument upward. As an illustration of the wide range of brightness that can be measured by this means it may be mentioned that the writers have measured values of over 50 ft.-candles in shop windows, while it is also possible to estimate the brightness of the sky in the night time. This proved in one case to be about 0.008 ft.-candle. In another case, owing to the diffusion of light from neighboring arc lamps, a value of 0.015 ft.-candle was registered. Although mainly intended for the measurement of surface brightness, the instrument can be easily employed to measure illumination. In this case a white surface is exposed to the illumination of the standardizing lamp, and the same surface is used for subsequent measurements. For this purpose a screen that is diffusive and dead-white is desirable.—Lond. *Electrician*, Oct. 28.

Metallic-Filament Lamp.—A note on an anti-vibration metallic-filament lamp for use in mills, factories, ships, etc. The tungsten filament is divided up into a larger number of short loops than is usual, and has a specially elastic suspension.—Lond. *Elec. Eng'ing*, Oct. 27.

Swedish Water-Power Plant.—H. Chervet.—The first part of a profusely illustrated complete description of the Yngeredsfors power plant and 40,000-volt transmission line to Varberg and Mölndal-Gothenburg, in Sweden. The power station at Yngered deals with a normal discharge of 1630 cu. ft. of water per second at a head of 59 ft., and contains three generating sets each of 2750 hp, supplying three-phase current at 4000 volts, 50 cycles, to three single-phase, 40,000-volt transformers. Energy is transmitted over a line fifty-six miles (94 km) in length at 40,000 volts to the Mölndal substation, at the Gothenburg end of the line, where about 8000 hp is transformed to suitable pressures for distribution among the many cotton and paper mills and other factories in the Gothenburg suburbs of Mölndal, Krokslätt, Garda, etc. At the further substations of Krokslätt and Garda, in Gothenburg City, the pressure of the three-phase current from the Mölndal transformer station is reduced from 10,000 volts to 210 volts and 400 volts and distributed by means of overhead cables. At the Varberg transformer station, of 2400 kva rating, the line pressure is reduced to 4000 volts and the energy led to the substation in the town through two underground cables. There the pressure is reduced to 800 volts to supply energy to the motor network, and a storage battery is installed. The Varberg electricity works, of which this substation forms a part, also contain a complete 2750-hp steam turbo-generator plant. This is intended to act as a reserve or stand-by in case of disturbances or low water at Yngered, in which case the transformers would have to step up the e.m.f. to 40,000 volts to assist the main line. The article is to be continued.—Lond. *Electrician*, Oct. 28.

Generation, Transmission and Distribution.

Location of Transformer Stations in Three-Phase Systems.—C. Schmidt.—The first part of a paper on problems of energy distribution in urban and interurban systems. In the present instalment the author discusses the most favorable distance between transformers in three-phase systems. This distance is determined on one hand by the cost of energy distribution per kw-hour and on the other hand by the permissible voltage variations due to incidental overloading of partial circuits, such as may be caused by the connection of a 5-hp motor to the mains. In general it is desirable to connect motors with a rating up to about 5 hp directly to the low-voltage network. Curves are given showing under what conditions the cost becomes a minimum.—*Elek. Zeit.*, Oct. 27.

Large Gas Engines.—F. Foster.—A paper read at the Manchester Engineering Exhibition. After mentioning the various types of large gas engines the author discusses the difficulties experienced in their manufacture. In this connection cylinders, pistons, cross-heads, valves, valve gear, frames, etc., are considered, and the improved forms of construction now adopted are described. Finally, the higher cost of gas engines, as compared with steam engines, is shown to be justified. The gas engine is a great saver of fuel, and customers "ought to be only too pleased to pay the extra cost of one." In a steam engine the ratio of maximum effective to average pressure is 2.2 for each cylinder; in a gas engine, however, the ratio is about 11, or five times that of the steam engine. The parts, of course, have to be strong enough to withstand the maximum pressure. By putting two cylinders in tandem the connecting rod, main frame and crank shaft are not subjected to any higher stresses, but the intermediate frame, back piston rod, cylinder barrels and valve gear remain as before. Hence, even in this case, the ratio of maximum to average pressure for the whole engine is nearly 4, as against 2.2 for the steam engine. Further, the severe conditions under which the gas engine works

necessitate more expensive materials than in the case of steam engines. The wonder is that gas engines are as cheap as they are.—Lond. *Electrician*, Oct. 28.

Electric Driving of Rolling Mills.—In the British Appeal Court the decision of Justice Parker early in the year, in which he declared the Ilgner patent for the electrical driving of reversing rolling mills to be invalid for want of subject matter, was upheld. The court expressed the opinion that the Ilgner patent merely combines the Ward-Leonard system with the addition of a flywheel, and that no new result is obtained by the combination.—Lond. *Elec. Eng'ing*, Oct. 27.

Traction.

Single-Phase Locomotive.—The Oerlikon Company has recently completed, for service on the Loetschberg Railway, a 2000-hp, 15,000-volt, single-phase locomotive using compensated-series motors. The results of a number of trial runs show that with a 15,000-volt, 13-cycle to 17-cycle current it is able to develop a draw-bar pull of 13,000 kg (28,600 lb.) when running at a speed of 42 km (26.3 miles) per hour, this being equal to 2000 hp developed at the draw-bar. The speed can be regulated up to 70 km (43.5 miles) per hour. On starting the draw-bar pull rises up to 15,000 kg (33,000 lb.). The load on each axle is about fifteen tons, the total weight eighty-eight tons, this being the weight also available for adhesion and equal, therefore, to 6.7 times the draw-bar pull. The locomotive has a total length of 15 m (49 ft.). If it is desired to increase the speed at which the normal draw-bar pull has to be exerted, so as to make it approach the maximum speed, the locomotive can be made to travel at a 60-km (37.4-mile) speed, developing 3000 hp, by making a slight modification to the secondary winding of the transformer, no increase in weight being necessary. The electric equipment consists of two similar parts, two current collectors, two transformers, each with the corresponding switches, two motors, and two complete controllers. The connections are so arranged that in case of need the locomotive can be started with a single motor, transformer and controller. The mechanical equipment of the motors can easily be uncoupled from the driving axles. The electric equipment can be worked with three-phase current at the same power, with only slight alterations. The motors can also run with direct current at 4000 volts without sparking, after suitably adjusting the shunt resistance of the auxiliary pole winding. The two transformers are designed for a normal continuous output of 2×1000 kva; they are air-cooled. The motors are 12-pole, compensated, series machines, with phase-displaced reversing fields. Each motor, with its toothed-wheel gearing, has a total weight of 9600 kg. The locomotive is complete, with air-compressor set, air brakes and all necessary equipment. It is used for the service on the Speiz-Loetschberg-Simplon line, drawing a train load weighing 310 tons up gradients of 27 mm per meter (1 in 37) at a speed of 42 km (26.3 miles), thus developing a draw-bar pull of 10,000 kg (22,000 lb.). The maximum speed is to reach 70 km (43.5 miles).—Lond. *Eng'ing*, Oct. 28.

Gasoline-Electric Omnibus.—An illustrated description of a new pattern of gasoline-electric omnibus chassis in which the road wheels are driven through differential and worm gear by a single series-wound motor receiving energy from a generator coupled to the gasoline engine. Direct drive is not resorted to at any speed, and starting and speed control is effected by means of the engine throttle valve and the generator field strength. The motor field coil is shunted at top speed. No storage battery is carried, and the maintenance costs are, it is claimed, low. Two such vehicles have recently been shipped for public service in India, and a modified pattern is to be employed in London.—Lond. *Elec. Eng'ing*, Oct. 27.

Installations, Systems and Appliances.

British Generating Station.—An illustrated description of recent extensions of the Carville electric generating station. It formerly contained four steam turbines, two of 6500 hp and two of 3000 hp. The latter two have now been replaced by machines of 6500 hp and, in addition, four more, each of 6500 hp, have been added, thus bringing the total rating of the station up to 52,000 hp. A new departure has been made in connection with the switchgear for operating the generator and feeder circuits. In the original installation the high-pressure switchboard was erected on four galleries at one side of the building, extending the whole length of the engine-room, the two upper galleries containing two sets of busbars and the next gallery being occupied by the main oil switches, while the last gallery was occupied by the instrument transformers and other auxiliary gear. By the recent arrangement the operating panels of the remote-control feeder switches have been placed in a control-room at one end of a new two-story brick building, which houses the operation department, battery-room and offices, as well as containing the control equipment.—Lond. *Elec. Review*, Oct. 28.

French Central Station.—A. SOULIER.—An illustrated detailed description of the equipment of the Mont-sur-Marchienne central station, which is of moderate size only, but is considered up to date in its equipment with modern machinery. There are two gas engines, each driving a 70-kw, 500-volt, direct-current generator. For distribution the three-wire system at 2×250 volts is used, the motors being connected between the outers. A balancer is used to equalize the load between the two halves. A storage battery is used to provide energy for lighting when the generators are at rest. The battery is charged by means of a booster.—*L'Industrie Elec.*, Oct. 25.

Electric Plant for India.—G. E. WRIGHT.—An article giving notes on the selection of electric plant and supplies for India, dealing especially with the rating of generators and motors, power-house equipment and low-tension transmission work.—Lond. *Elec. Review*, Oct. 28.

Three-Phase Systems.—G. W. MEYER.—Numerical examples showing the application of the symbolic method for the calculation of three-phase systems with star connection.—*Elek. Anz.*, Oct. 23.

Electrophysics and Magnetism.

"Potential Power."—E. J. BRUNSWICK.—The author does not like the term "puissance dewattée" (wattless power) and proposes instead the term "potential power."—*L'Industrie Elec.*, Oct. 10. P. Boucherot objects to this because potential power should logically be the rate of the variation of potential energy in time, which is proved to be something essentially different. He prefers the term "magnetizing power." E. Brylinsky proposes the term "reactive power."—*L'Industrie Elec.*, Oct. 25.

Röntgen Rays.—G. RÜMELIN.—An illustrated description of an arrangement of apparatus to produce Röntgen rays of practically constant intensity.—*Phys. Zeit.*, Oct. 15.

Electrochemistry and Batteries.

Ventilation of Storage Batteries.—A note on a recent British patent (4567, Oct. 20, 1910) of A. B. Pescatore and Tudor Accumulator Company. Cells for boats, etc., are provided with a system of ventilation for removing the gases evolved during charging and for cooling the electrolyte. The gases are removed through an aperture in the center of the lid and cool air is introduced by means of pipes passing through the lid near this central aperture and terminating in the corners of the cell. Air may be blown in or suction applied, as is most convenient.—Lond. *Elec. Eng'ing*, Oct. 27.

Electrolytic Hypochlorite for Cleaning Schoolrooms.—A note on the use of electrolytic hypochlorite solution (made from common salt) in the schools of the Borough of Poplar in England. The directions given to the school-keepers are to soak with electrolytic fluid the sawdust used for scattering over the floor and to sprinkle the floors with the fluid by means of an ordinary galvanized-iron watering can with a large rose on the spout. The scattering of the soaked sawdust and the sprinkling of the floors with the fluid are being daily carried out previous to sweeping the floors, as dry sweeping only spreads the dust; for, while part of it is removed, the rest, which has been stirred, settles down when the disturbance is over. The school-keepers are also directed to use the fluid in the water when washing the floors of the classrooms. If the fluid is not diluted enough, a strong odor will be given off at the time of sprinkling or washing, on account of the presence of organic matter in or

upon the floors; consequently the oxidizing process should be gradual.—Lond. *Electrician,* Oct. 28.

Calcium Cyanamide.—M. de Kay Thompson and R. H. Lombard.—An account of an investigation of the equilibrium of the system consisting of calcium carbide, calcium cyanamide, carbon and nitrogen. In the present instalment the arrangement of the experiments is described and an account is given of the electric furnace used, the calibration of the thermo-couple, etc. —*Met. and Chem. Eng'ing,* November.

Units, Measurements and Instruments.

Mercury Motor Meter.—An official announcement of the Reichsanstalt by which a direct-current motor meter of the Solar Meter Company is admitted for calibration. The construction is shown in Fig. 3. The positive current enters the motor at K_1 and passes first through the winding of an electromagnet; it then divides into two branches, one passing through the mercury and the other through the resistor W. After the current combines again it leaves the meter through K_2. The mercury is entered by the current through E; it passes then mainly through the copper disk T and leaves the mercury at A. Above and below this path of the current are two poles, P_1 and

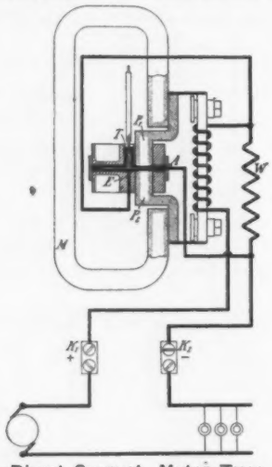


Fig. 3—Direct-Current Motor-Type Meter.

P_2, of the steel magnet M. In this way there is exerted on the disk a torque proportional to the current. By the rotation eddy currents are produced which brake the movement. Since the rotation of the meter would be too slow at full load on account of the friction of the liquid, the arrangement is so made that an increasing additional magnetic flux is produced with increasing current. The purpose of the resistor W is to reduce the influence of temperature on the meter.—*Elek. Zeit.,* Oct. 27.

Wattmeters.—J. Zenneck.—In high-tension, alternating-current systems transformers are generally used to connect the measuring instruments with the low-tension circuit. But in power measurements in high-tension systems containing large flame arcs the use of transformers may cause considerable errors. Reliable results are obtained only if the current coil of the electrodynamic wattmeter is directly inserted in the high-tension line and the voltage coil is connected in series with non-inductive resistors across the line. Since the instrument is thereby charged to high voltages purely electrostatic forces are acting on the movable system and this causes an error which cannot be neglected. This error depends on the position of the movable coil—that is, of the needle—and it is necessary to predetermine this error for as many positions of the coil as possible over the whole scale. Methods of determining this error are described, especially one in which the deflection of the needle is obtained by means of an auxiliary magnetic field. —*Phys. Zeit.,* Oct. 15.

Standard Resistance Unit.—A note on a recent British patent of W. R. Rousfield (27,335, Oct. 20, 1910) for a standard resistance unit suitable for heavy currents, consisting of a glass tube filled with mercury and provided with platinum contacts at each end. These contacts extend into glass cups at each end, which may contain mercury and serve as connectors to the rest of the circuit. A vertical tube of fine bore is attached to the main tube, and the mercury rises in it according to the temperature of the whole. This tube may be graduated in degrees of temperature or in ohms.—Lond. *Elec. Eng'ing,* Oct. 27.

Selenium Cell.—An illustrated description of a new selenium cell devised by Gripenberg. The object is to utilize the light which is reflected by a selenium cell. For this purpose a series of selenium layers is provided so that the light reflected by one layer falls upon the next one, and so on.—*Elek. Anz.,* Oct. 27.

Telegraphy, Telephony and Signals.

Telegraph and Telephone Conference.—The first part of a very full account of the recent Paris conference of government telegraph and telephone engineers. This was attended by the chief officials of the telegraph and telephone departments of the governments that subscribe to the International Telegraph Convention and Service Regulations represented by the bureau at Berne. The United States was represented by Messrs. C. E Scribner, engineer-in-chief of the Western Electric Company, of New York, and John J. Carty, engineer-in-chief of the American Telegraph & Telephone Company, of New York Abstracts of the papers presented at this conference are given elsewhere in the Digest.—Lond. *Electrician,* Oct. 21 and 28.

Manual and Automatic Telephone Exchanges.—An account of the extended discussion held at a recent Paris conference of government telegraph and telephone engineers. Steidle, in his report, remarked that the discussions on the subject at Budapest had been confirmed by practical experience. In the great and small systems on the Continent of Europe automatic use is made of systems which had proved their reliability and adaptability to technical requirements. The use of automatic table selectors is now only a question of economy. In order to illustrate this aspect of the different technical methods of working, Steidle showed some diagrams of the cost of illustration. He pointed out that in the case both of the semi-automatic and automatic systems the economical advantage is always increasing owing to the growth of telephonic communication and the constant improvement of technical devices. Purely mechanical selectors provide the most economical method of working, and he showed that the development of cheap telephony in urban and rural districts would be encouraged by the use of semi-automatic arrangements permitting the connecting up of small groups of subscribers—central secondary exchanges connected with principal exchanges having a manual service. Hersen said that, as the manual service cannot at present be entirely abolished, it is desirable to consider whether that service cannot be improved by performing some of the manipulations automatically, as is done at Copenhagen. Similarly, attempts had been made in Germany to install an automatic line selector for insuring uninterruptable conversation, as well as an automatic distributer of subscribers' calls for interurban communication. He asked Steidle whether he had considered, from the economic standpoint, the question of adopting automatic or semi-automatic working—that is, whether or not to retain, as regards the subscriber, the numbered call disk. Mr. Steidle replied that, economically, American statistics as to the relative cost of connections showed a difference of 15 per cent in favor of the entirely automatic system. There are also advantages of working to be considered. At Munich-Schwabing it is found that subscribers are quite used to the manipulation of their instruments, including disks numbered with series of five successive figures. Technically the automatic system is preferable as being more simple. Mr. Hersen asked for the number of calls per hour employed as a basis for the estimates given by Steidle. In Berlin it is considered that one telephonist can deal with 250 calls hourly. It had been stated that in America 1500 conversations per telephonist per hour are possible. Steidle replied that he had taken as the basis for his calculations per telephonist per hour the figure of 800 subscribers' calls for the semi-automatic service and from 140 to 150 conversations for the manual. He asked which is considered preferable, a call selector or an individual manipulator. Hersen said one must consider the time necessary to make contact with the calling

line. If this contact takes place at a distance from the indicator (curseur) time would be necessary, and the subscriber may commence to call before connection is made. This is a drawback in the call-selector system. If it were proposed to introduce it by means of the entirely automatic system one would prefer individual manipulation. Otherwise, for economical reasons, the semi-automatic system combined with the cell selector would be preferred. John J. Carty observed that he could only speak as to American practice. The automatic and manual systems are usually contrasted, but the automatic system is not entirely automatic and the manual system advantageously admits of automatic movements, especially in large systems. Moreover, the apparatus installed would be in use for periods varying from five to twenty years, and it is necessary to consider the system from the point of view of its probable developments. Thus in New York in 1900 there were 43 central exchanges and 51,398 subscribers to 3,437,000 inhabitants; in 1910, 52 central exchanges and 376,000 subscribers to a population of 4,800,000; while in 1930 there will be 109 central exchanges and 2,142,000 subscribers to 8,800,000 people. Further, it is necessary to meet the suburban and interurban services. In considering an automatic system for a very large town one is astonished to find how many manipulations are still necessary. In America an automatic system which is not suitable for small private central exchanges (branch centers) is not practicable on account of the great number of these small private stations. In 1900, in New York, there were 1050 private exchanges, serving 12,650 points; in 1910, 11,960, serving 162,560 points; while for 1930 it is necessary to estimate 88,400 exchanges, serving 1,079,000 points. The operating company, therefore, reckons on supplying nearly 80 per cent of the subscribers under these special conditions; and as up to the present no way has been found of operating the small exchanges from the central exchange, it is necessary to retain the operators. Automatic telephony requires, in addition, a numerous staff of electricians to insure the working of the exchange. In Connecticut investigations had been made with the view to the introduction of the automatic system, and it had been found that the manual method would require 892 operators and the automatic 600. For New York similar investigation showed that for 100,000 subscribers, counting the operators in small private central stations and the mechanicians in the automatic exchanges, 13,000 operators would be required for manual method and only 10,000 for the automatic. The question to be solved is not, therefore, definitely whether the automatic or the manual system is to be decided upon, but rather in what parts of the systems and at what moment in the connection it is desirable to have manual or automatic operation. A manipulator is always necessary to receive subscribers' calls; thus the best system is that which provides the subscriber with the simplest installation and leaves complicated operations to the central exchange. Semi-automatic least satisfies these conditions. In New York, with the manual method, it is possible to state the time necessary for making the connection at from thirty to fifty-two seconds, with a maximum of eighty-seven seconds. This is an excellent result, which permits one to consider the problem completely solved by the manual system. He said that he had not found any automatic method so satisfactory as the present manual system with central battery, but he had no prejudice on the subject and remained always ready to consider propositions. Steidle then proposed the following resolutions: "In view of trials made in different countries it is possible to affirm: 1. That automatic and semi-automatic systems offer at present, from mechanical and electrical standpoints, sufficient certainty and adaptability of operation to meet all working requirements. 2. The adaptation of these systems no longer depends upon the economic factor, which naturally varies according to the country." Hersen remarked that in Germany two central exchanges with 1000 subscribers require only two mechanicians, and a small exchange works without a special mechanician. Milon had also visited the principal automatic exchanges in America. The number of technical faults in subscribers' apparatus in the more perfect systems was higher by about one-fourth than those reported in the manual service, the former requiring 50 per cent more mechanicians than the latter—say, one mechanician present at the exchange during the busy hours per 1000 subscribers. Since, however, the automatic system suppresses errors or manipulation faults of operators, this system is quite comparable with the manual system. The question is whether the subscriber will make the needful manipulations himself or prefer the intermediary of a telephonist as in the semi-automatic system. The answer would vary in different countries according to the character of subscribers and quality of staff. As to depreciation, he stated that selective apparatus has worked seven years without material wear. In regard to cost of installation, contractors estimated that it is slightly higher than that for a manual installation. The president recapitulated the discussion and said that while it might not be possible to end it by a vote the conclusion appeared to be that the satisfactory application of automatic working is no longer doubtful, but that the advantages would depend on local conditions.—Lond. *Electrician*, Oct. 21.

Telegraphy.—W. A. J. O'MEARA.—The conclusion of his article (the first part of which was abstracted in the Digest some time ago) giving some notes on the author's trip to the United States. As to the status of telegraphy he says that the Rowland machine has a great carrying capacity when all things go well, but it is a rather complicated machine. The Barclay printing telegraph machine operates on the polar duplex principle, and, being a non-synchronous system, it has a wide range in line current values. Comparative tests have given convincing proof of the advantages of tape transmission over the direct signaling to line. Theoretically, the former appears to involve a loss of time in handling individual messages, but in practice the saving of time in the case of direct transmission can occur only if everything works with smoothness and the staff is so skilled as never to make a mistake of any kind. In practice such conditions will never prevail, and it is for this reason that the tape transmission exhibits its superiority. Some notes are added on the use of electric power in post offices in the United States for conveying mail, etc., the telephone tunnel system in the streets of Chicago and the municipal works at Seattle.—Lond. *Electrician*, Oct. 28.

Interference Between Energy Transmission Lines and Telephone Lines.—An account of a discussion at the Paris Telephone Conference. Collette reported on the subject of "the coexistence of strong and weak current lines." Pleijel cited the case of a railway using for traction alternating currents of 15,000 volts with a frequency of 25 cycles or 15 cycles per second. The railway followed for 6 km (3½ miles) telegraphic and telephonic lines which were then connected with Stockholm by cables of 5 km (3 miles). The telephonic lines were on one side of the road, the telegraphic on the other. On the former only a slight sound was discernible when the trains started or

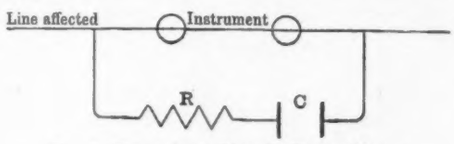


Fig. 4—Secondary Circuit Connections.

stopped. The tension between these lines and earth, when insulated at the Jaspra end, was about 20 volts. On a telephonic line carried on the posts supporting the transmission line there was a tension of 5000 volts. This line was at first unusable, but after having substituted for the lightning guards an induction coil placed between the two line wires, the middle being connected to earth, conversation was possible. On the other hand, it had been found necessary to have a metallic circuit for the telegraph lines. Measurements showed that 75 per cent of the disturbing currents were electrostatic (difference of potential between earth plates) and 25 per cent electromagnetic. Strecker mentioned two methods used in Germany to render telegraph

instruments insensible to disturbances from alternating currents. In one method (Fig. 4) a secondary circuit is attached to the terminals of the apparatus comprising an inductive resistance and a syntonized condenser, with the same frequency as the alternating current, through which the alternating current elects to pass while the continuous working current passes through the instrument. The second method (Fig. 5) bridges

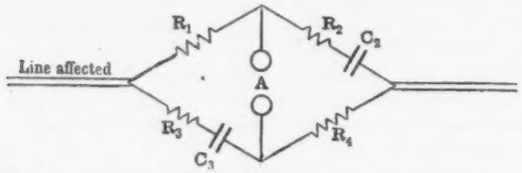


Fig. 5—Apparatus Bridged Between Similar Branches.

the apparatus between two similar branches composed of inductive resistors and two syntonized condensers, so arranged that the continuous current alone can operate the instrument. Pleijel observed that a condenser of such great capacity is necessary that the working of the instrument is retarded and that the power must be increased. He had also used electrolytic capsules, but they also have disadvantages.—Lond. *Electrician*, Oct. 28.

Wireless Telegraphy.—Ferrie.—An article on the equipment of dirigible balloons with wireless-telegraph apparatus and the results obtained in recent tests made by the French army. With the balloon Bayard-Clement it was possible to transmit messages over 100 km (60 miles) at an expense of less than 50 watts.—*La Lumière Elec.*, Oct. 22.

Transmission of Pictures.—B. Glatzel.—In the second instalment of his paper the author gives a review of recent improvements in telautographic apparatus. It is important to reduce as much as possible the inertia of the light relay. Instead of the double-wire light relay, as described in the Digest last week, a single ribbon may be employed according to the principle of Edelman's thread galvanometer. Receivers employing this principle are more sensitive than the telephone, oscillograph or any electrochemical receivers.—*Elek. Zeit.*, Oct. 27.

Bookkeeping.—G. Johnson.—A continuation of his article on bookkeeping and accounts of telephone undertakings. In the present instalment the author deals with the routine between the manager and engineer in regard to construction, withdrawal and other orders, and accounts of stores, etc.—Lond. *Elec. Review*, Oct. 28.

Miscellaneous.

Insulation Materials.—W. Fellenberg.—The conclusion of his very long serial on the development of the electrical industries in the United States and Germany. In the present instalment statistical data are given on insulators, porcelain, gutta percha, mica and asbestos. In conclusion the author points out that the United States has the advantage of having the raw materials for the electrical industries in its own country, while Germany has not. But Germany has the advantage of a greater number of better trained workingmen. The absolute value of the wages is less in Germany than in the United States, since food costs more in Germany. The endeavor of all German industries must be to keep their corps of workingmen satisfied by reducing the cost of living. A change of the tariff law is recommended. If that is not done soon the author thinks the foundation of Germany's trade in the markets of the world will break down. Untrained workingmen receive about the same wages in Germany as in the United States.—*Elek. Zeit.*, Oct. 27.

Electric Accidents.—W. Vogel.—The first part of an account of the electric accidents which happened in the industrial establishments and mines of Upper Silesia during the last year. Fifteen accidents are dealt with, of which eight caused the death of a man. In one case a man was killed by 220-volt direct current.—*Elek. Anz.*, Oct. 23.

Book Reviews.

Fuel and Refractory Materials. By A. Humboldt Sexton. Second edition. New York: D. Van Nostrand Company. 364 pages, 104 illus. Price, $2.50.

The production, handling, testing and utilization of fuels form the subject of the present volume. The general theory of combustion and heating power of fuels is followed by a description of the various fuels (coal, wood, peet, coke, charcoal, oils and gases), their properties and methods of production. A chapter is devoted to furnaces for metallurgical purposes, this being followed by one on pyrometers, calorimeters and fuel testing. The book closes with a brief treatment of refractory materials, giving their properties, composition and some notion of their manufacture into bricks and crucibles. The book is suitable for a text, but should be a useful source of reference to those interested in gas producers, coke and charcoal manufacture and metallurgical furnaces.

Die Seekabel Unter Besonderer Berucksichtigung der Deutschen Seekabeltelegraphie. By H. Thurn. Leipzig: S. Hirzel. 288 pages, 105 illus. Price, 9 marks.

This is an elementary and descriptive volume, abundantly illustrated, giving a very readable account of modern submarine telegraph cables as made in Germany and laid by German ships.

The first chapter is devoted to technical matters and very elementary theory. This occupies about one-third of the book. The remaining chapters discuss cable manufacture historically considered; the need for national cables; the German cable system; the traffic operation of cables; the influence of submarine cables in affairs; the competition between submarine and wireless telegraphy; arrangements for the protection of submarine cables. A good deal of practical and economic information is contained in the book, which will be very useful to cable telegraph engineers desirous of following the details of German practice. Evidently the writer has secured a series of photographs taken during a cable-laying expedition, because some of the pictures are not only instructive but entertaining.

Traité de Physique. By O. D. Chwolson. Paris: A. Hermann & Sons. Vols. 3 and 4. 838 pages, 291 illus. Price, 25 francs.

These volumes are devoted to special branches of physics, namely, Vol. 3 to thermometry, thermal capacity, thermochemistry and thermal conductivity, and Vol. 4 to the steady electrostatic field. It is a commentary upon the rapid growth of the physical sciences that books so complete as these should be treatises upon special branches only. The books are treatises largely by way of compilation. The subjects are developed in historical order, so that the various discoveries and accretions of knowledge are laid down in their order of sequence. A very full bibliography is appended to each chapter by way of supplementing the text.

The translation into French by M. E. Davaux seems to be excellent and effective. Although the work is very minute and detailed, yet the treatment will be more appreciated by the historian of physics than by the student who desires only to arrive at the present status of knowledge in these subjects. The book will be prized for reference by scholars in physics who are interested in tracing the growth of modern ideas and results in these branches.

The Theory of Electric Cables and Networks. By Alexander Russell. New York: D. Van Nostrand Company. 269 pages, 71 illus. Price, $3.

The volume is an elementary text-book of the fundamental principles which enter into the design, construction and use of direct-current cables and wires. It supplements to a considerable extent the more advanced work by the same author, entitled "Treatise on the Theory of Alternating Currents." The treatment of the subject is suited to the requirements of the

electrical engineer and also of the student of electrical engineering. Numerous references to special literature are given in relation to the different matters discussed. The chapters are entitled: Fundamental Principles, Conductivity, Insulativity, Distributing Networks, Insulation Resistance of House Wiring, Insulation Resistance of Networks, Faults in Networks, Dielectric Strength, The Grading of Cables, The Heating of Cables, Electrical Safety Valves and Lightning Conductors. The discussion is very clear and well arranged. The quantitative analysis is confined to simple algebra. Special attention is given to the theory of the various electric tests described. The book will be valued both by the practising engineer as a compendium of reference and by the student as a useful text-book in the subjects of which it treats.

New Apparatus and Appliances

A RECENT CONEY ISLAND SIGN.

The accompanying illustration, made from a drawing rather than a photograph, to indicate by the dotted lines the movement of the arms of the figures, represents one of the newer spectacular electric signs at Coney Island. The sign is 40 ft. high and 30 ft. wide and it contains 1100 4-cp carbon lamps. The table, chairs and the figures of the man and the woman, as well as the bottle on the table, are steady-burning. The arm of the woman is first seen raising a glass to her lips and then the man is shown

A Novel Electric Sign.

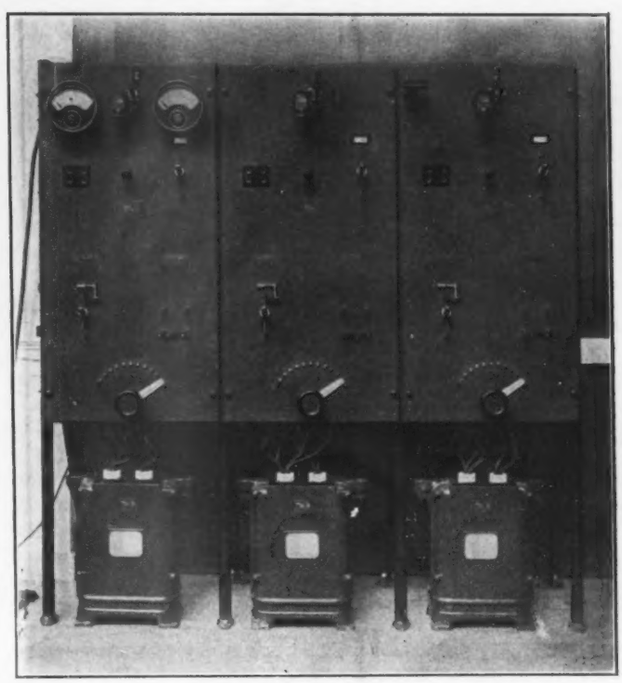
performing a similar action. The arms are seen throughout the whole range of movement. The lettering is flashed on at intervals, the line "Carstairs" first, then "Rye" and "A Century Favorite" at brief intervals, the words "Est. 1788" being last. This sign was made by the Hamilton Sign Company, of New York, and the flasher by which it is operated was supplied by the Reynolds Electric Flasher Manufacturing Company, of Chicago. In the flasher eight single-pole switches are necessary for the moving arms and six double-pole switches for the lettering.

TRAINING INCANDESCENT-LAMP SALESMEN.

The Harrison Works of the General Electric Company has extended its course of training for lamp salesmen by the inclusion of other than merely commercial instruction. Men taking this course have usually had some selling experience, but lack technical training in electricity and illuminating engineering. The duration of the present course is three weeks, the instruction consisting of experimental lectures, recitations, readings, selling talks, trips through the factory, laboratory work and talks by specialists from the commercial, engineering, sales and factory departments. The men at the end of the course are familiar with the adaptability of the various units and can design illuminating schemes and work out simple illuminating problems. The work is under the personal supervision of Prof. Sydney W. Ashe, who is provided with assistants to look after experimental and problem work on lamp data. A number of experienced men have also been trained to give experimental lectures and these men are available to the various central stations for lectures to their employees. Such subjects as sign lighting, industrial lighting, automobile lighting, street illumination, store lighting, etc., are among those included in the list.

RECTIFIER FOR COMMERCIAL-VEHICLE SERVICE.

The accompanying illustration shows a mercury-arc rectifier for commercial-vehicle service, exhibited for the first time as a part of the General Vehicle Company's display at the recent electric show in New York City. This rectifier is of the ordinary type except that many of the parts necessary for use with pleasure vehicles are now eliminated on account of the standard voltage requirements of commercial vehicles, where forty-hour

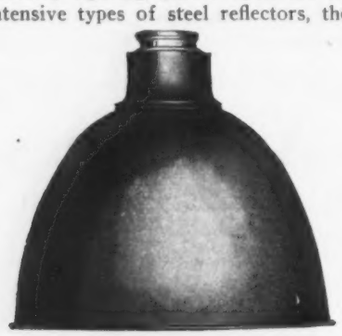


Rectifiers for Commercial-Vehicle Service.

cells are used almost exclusively. The board is substantial in character, the wiring simple and ample in carrying capacity. A most efficient board is produced at the lowest price by a plug system enabling one set of meters to be used for every three panels, each of which can be equipped with any of the standard tubes ranging from 30 amp to 50 amp each. Where necessary this rectifier is supplied with a special switch on each panel, enabling two or more panels to be run in multiple so as to accommodate charging of batteries at high amperage. The meters supplied are of the large type easily read by the operator. The General Electric Company is the manufacturer of the rectifier outfit.

NEW INTENSIVE AND EXTENSIVE STEEL REFLECTORS.

Something over a year ago the Holophane Company, anticipating the need both of better practice and better equipment for mill and factory lighting, placed upon the market its extensive and intensive types of steel reflectors, these being the



Extensive-Type Steel Reflector.

first scientifically designed metal reflectors available for tungsten lamps. While the company considers that these were the most satisfactory reflectors of their type available, from the standpoint of both efficiency and practicability, it was early seen that there was room for improvement, and the Holophane engineering department at once set about redesigning and perfecting the company's product. The results of this work are now being offered to the trade.

The new Holophane-D'Olier steel reflectors shown in the accompanying illustrations are stated to give an average increase of 31 per cent in illuminating efficiency, this increase being

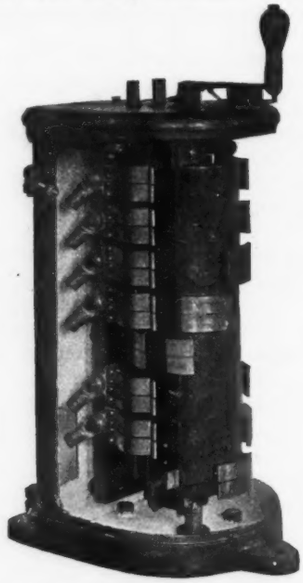
Intensive-Type Steel Reflector.

practically the same for both the intensive and extensive types, while the distribution of light is much more advantageous, it being possible to install the new reflectors on exact spacings with the same certainty of obtaining uniform illumination as is the case when Holophane glass reflectors of the standard types are employed. A third advantage claimed is that the angle of cut-off is as low as can practically be secured, thus reducing glare effect to the minimum. It will be seen that in appearance the new steel reflectors are attractive.

DRUM-TYPE STARTERS FOR ALTERNATING-CURRENT MOTORS.

For starting under load the slip-ring motor has many advantages over the squirrel-cage induction motor. When provided with the proper starting device it is possible to get gradual acceleration with no excessive currents. Up to certain capacities the Cutler-Hammer face-plate type of starter is practicable, but for larger motors the new drum-type illustrated below is preferable. For use in industrial plants and where subject to collection of dust, lint, etc., it is especially adapted, as there are no exposed contacts. The standard sizes manufactured range from 10 hp to 200 hp.

The drums are tightly fitted and the contacts and brushes are made of hard-drawn copper and can be readily and cheaply renewed. The cylinder on which the contacts are mounted is built to remain perfectly true under all conditions. This type of apparatus can be handled by any workman without danger of accidental contact or other trouble. The cutting out of the resistance and the acceleration can easily be controlled. All connections are made inside the drum and the arrangement of the terminals renders them readily accessible. For larger motors,



Drum-Type Starter for Alternating-Current Motors.

or those starting under specially heavy load conditions, a multiple-switch type of starter has been developed and is recommended by the manufacturers.

ELECTRICALLY HEATED MELTING POT.

In many industrial establishments it is imperative that means be afforded for melting lead, solder, etc., in greater or less amounts. This has been generally accomplished by means of devices heated by coal, gas, gasoline, oil or other dangerous and unhealthful heat producers, which involve a fire risk in addition to their other objectionable features. An electrically heated device, illustrated herewith and manufactured by the General Electric Company for this purpose, has been designed to obviate these objections. It is clean, sanitary and without odor, and as its operation is not attended with a fire hazard, it can be used

Metal Melting Pot—Designed for 1000 Lb.

anywhere, even where combustibles are scattered about, while its control is so easy and certain that it can be regulated so as to maintain the molten metal at the proper temperature for best results. It is always ready for use, a throw of the switch turning on the heat, and is of extensive application, being suitable for melting lead, solder, babbitt metal, for tinning, dipping and soldering wires and other small articles, for tele-

phone manufacturing establishments, electrical repair shops, etc.

In construction it is a shallow circular vessel of cast iron, the cup being assembled on top of the heating disk and the design being such that the heating unit is readily accessible. There are three degrees of heat regulation, consuming 200 watts, 400 watts and 600 watts respectively. The standard device has a maximum capacity of 15 lb. and is designed for attaching to electric circuits where the potentials are 100 volts, 110 volts or 120 volts by standard attaching plug. In addition to the smaller sizes kept in stock units will be built to order having a capacity (for lead) of 700 lb., 1000 lb., 2100 lb., 2500 lb., 3000 lb., 3150 lb. and 3500 lb. respectively. Some large ones are now being built having a capacity of 1000 lb., one for a large shipbuilding company, to be used as a tin melting pot, and another for a large paper manufacturer for use in melting stereotype metal in the printing department.

QUARTZ-TUBE MERCURY-VAPOR LAMP.

There has recently been developed for the market in England the type of mercury-vapor lamp shown in Fig. 1, which is somewhat similar in appearance to an ordinary arc lamp, but much neater and less bulky in construction. Referring to Fig. 2, the lamp consists of the following four parts: First, a clear or opal globe *E*, which is metal-flanged and arranged to fit securely on the underside of the totally inclosed metal case *D*, or to lower at will to the extent of the length of the chains *C*, which prevent further falling of the globe, thereby leaving the inside open for inspection, etc. Second, a quartz tube *A* of somewhat irregular shape, exhausted to a high degree of vacuum and containing a quantity of mercury, which is the source of light, the luminous portion in the smaller capacity lamps (1200 hemispherical candle-power, 4 amp, 100-130 volts) being about 1¾ in. and in the larger (3000 hemispherical candle-power, 3.5 amp, 200-240 volts) about 4 in.; the tube is mounted within the globe on the outside of the base of *D*, and is arranged so that it can be tilted in order that the mercury may be free to run to and from each end. Third, a solenoid *B*, the plunger of which is connected to one end of the quartz tube, and an automatic cutout *i*, both mounted on the

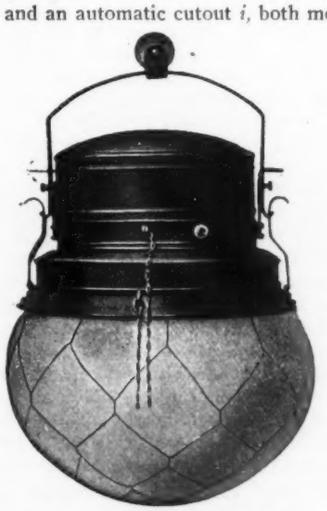


Fig. 1—Quartz-Tube Mercury-Vapor Lamp.

inside of *D*. Fourth, an external resistor *R*, mounted in any convenient place.

On putting the lamp in circuit by switch *I* the current first passes from the positive main through the resistor *R*, the cut-out *i* and the solenoid *B* back to the negative main, the solenoid causing the positive end of the tube to be tilted and the mercury to flow along the tube to the opposite end, thereby completing the tube circuit. As the cut-out coil is in series with the tube this now comes into operation and immediately breaks the solenoid circuit. The quartz tube then falls back to its original position and the lamp continues to operate until it is switched off. As soon as the mercury at both ends of the quartz tube meets and the current in the tube is thereby started a small portion of the mercury is vaporized. The vapor alone only constitutes the conducting medium in the tube and is the sole source of light, there being a continual process of vaporization and condensation whenever the lamp is in service.

As it is essential that the correct polarity should be observed, to prevent damaging the tube means are provided in the lamp itself which automatically insure this, as under reversed conditions the lamp will fail to light up. In comparison with arc lamps the mercury-vapor lamp embraces an absolutely steady

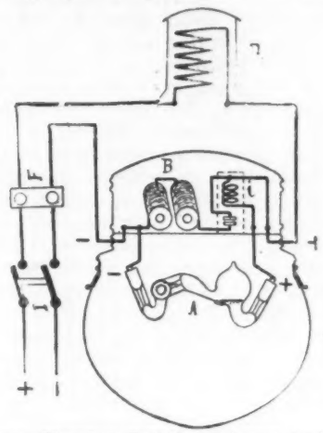


Fig. 2—Diagram Showing Details of Lamp and Connections.

light of uniform quality with no flickering, and is designed for running in parallel, thus insuring economical use.

The shadows shown by ordinary arc lamps are to a large degree eliminated by the use of the mercury-vapor lamp, owing to the fact that the actual length of the arc in the former is very much smaller than in the latter type. The light is bluish-white in color, makes a good illumination for streets, markets, railway depots, freight yards, wharves, docks, steel works, heavy foundries, factory yards, sheds, etc.

In Fig. 3 is shown the polar photometric curve of a lamp consuming 3.64 amp at 220.3 volts and giving 3630 mean lower

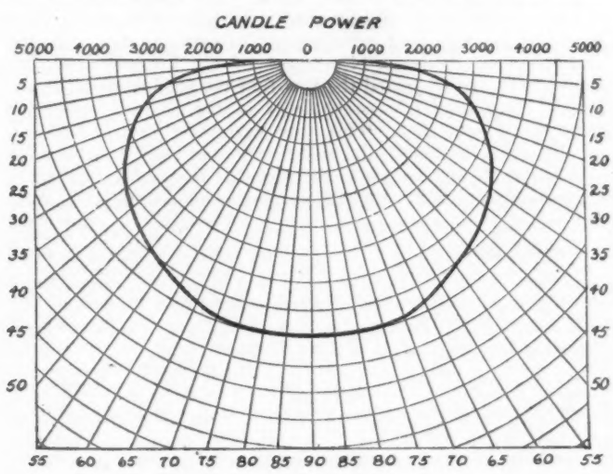


Fig. 3—Light Distribution Curve.

hemispherical candle-power. Owing to the high efficiency, combined with the long life of the burners, together with the fact that the lamps require no attention during running, the total running cost per hour is considerably less than that of ordinary or flame-arc lighting—the actual figures are stated to be 1.14 cents and 2.2 cents per hour, taking the price per kw-hour at 2 cents and 6 cents respectively, which compare with 3.64 and 5.13 cents for the flame-arc lamp.

This lamp has been placed on the market by the Westinghouse Cooper Hewitt Company, 151 Great Saffron Hill, Holborn Circus, London, England.

Industrial and Commercial News

The Week in Trade.

PRINCIPALLY on account of the colder weather trade reports for last week were uniformly more favorable than for some time past. Distribution in retail trade is quite generally improved, and the realization on the large corn and oats crops throughout some parts of the Southwest has furnished considerable buying capital. The wholesalers and jobbers report an increased volume of reorders. There is an especially active movement in holiday goods, and shipments are being made as rapidly as possible. In the industrial world there is very little improvement. The textile condition is still handicapped by the prevailing waiting policy. In the iron and steel industry there does not seem to be a great amount of new business coming forward. Many railroads have announced that their purchases of steel rails for the coming year will be limited to absolute necessities, and specifications for structural materials are also very light. The mills must have much more prosperity if operations during the coming winter are to be conducted at an average rate. The demand for wire products is the one bright feature in the general situation, but it is said that prices on both wire and nails are being shaded. The report of the United States Steel Corporation of the tonnage on its books on Oct. 31 was the smallest in the history of the company. It is claimed, however, that the figures are smaller, owing to a new method of computation, than they would have been had the method in vogue several years ago been followed. The preliminary reports for the October export trade were hardly as encouraging as had been expected. An increase over September figures had been looked for, but it now seems likely that the totals will show a decrease of about 4 per cent. Collections have improved very materially, and this is especially true in the corn-producing territory. Business failures for the week ended Nov. 10, as reported by *Bradstreet's*, were 207 as against 179 the previous week, 221 in like week in 1909, 267 in 1908, 259 in 1907 and 222 in 1906.

The Copper Market.

TAKINGS of copper during the past week were very light, and the market was extremely dull and uncertain. All grades were slightly shaded in price during the week, and there can be heard many reports of concessions being made under quoted figures. The report of the Copper Producers' Association demonstrated the fact that the production of copper during the month of October was at the rate of more than 4,000,000 lb. per day. This was extremely disappointing to many traders, although the report was generally considered to be a favorable one, owing to the fact that total deliveries during the month were heavy and the surplus stock decreased 9,531,800 lb. The official figures as given out were: Production, 126,469,284 lb.; domestic deliveries, 67,814,172 lb.; exports, 68,186,912 lb., making total deliveries of 136,001,084. The surplus stock reported on hand Nov. 1 was 139,261,914 lb. One feature in the report which has caused considerable comment in the metal market is that the figures given out for the exports are said to be 20,000,000 lb. in excess of actual shipments, according to the government's reports. It is pointed out that this excess is therefore still in this country and should naturally be added to surplus stocks. The demand by domestic consumers during the past week amounted to very little. While it is not believed that many melters are carrying large stocks, they seem to be very conservative about buying. The imports continue to run at about the same figures. Exports for the month, including Nov. 14, were 9703 tons. The daily call on the Metal Exchange Nov. 14 quoted standard copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	12.50	12.60	....
November	12.50	12.60	12.55
December	12.50	12.60	12.55
January	12.55	12.65	12.60
February	12.60	12.70	12.65

The London market, Nov. 14, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	57 7 6	58 6 3
Standard copper, futures	57 12 6	58 11 3

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c	11.70c
London, spot	£62 0 0	£52 15 0
London, futures	65 18 9	53 7 6
Best selected	65 10 0	57 15 0

Industrial and Commercial Notes.

Westinghouse and Georgia Power Companies.—A telegram was published under an Atlanta date in a New York paper last week to the effect that the Westinghouse Electric & Manufacturing Company had gained control of all the water powers on the watersheds of the Tallulah, Chattahoochee and Etowah Rivers. These include the Georgia Power Company, the North Georgia Electric Company, the Etowah Power Company and some smaller plants and hydroelectric sites. This telegram stated that the Railroad Commission had approved a $20,000,000 stock and bond issue for the Georgia Power Company for the purpose of carrying out this great merger. The Northern Construction Company, of Michigan, is reported to have made a contract for developing the holdings, and it is said that in the three rivers energy aggregating 101,000 hp can be developed. With regard to the Westinghouse connection with this matter Robert Mather, chairman of the board of that company, said: "There is no truth in this story whatever. This company has not acquired any Georgia power companies, and does not intend to. We are not in the business of acquiring power properties."

American Association of Electric Motor Manufacturers.—The convention of the American Association of Electric Motor Manufacturers, which was to have been held at the Blackstone Hotel, Chicago, Nov. 14-16, was called off some time ago and all arrangements canceled. It is understood that the association has been dissolved. While no member of the association who could be seen in this city would make any statement to this effect, none would make any denial. Privately, the opinion was expressed by several members that the association had been dissolved. W. H. Tapley is secretary of the association, and has offices at 29 West Thirty-ninth Street, New York. When asked about the association he said that its convention had been postponed indefinitely and no action with regard to it would be taken until the executive committee met again. He said that if the association had been dissolved he had no official knowledge to that effect. F. S. Hunting, of the Ft. Wayne Electric Works, is president of the association.

Apparatus for New York Central.—The New York Central Railroad Company has placed an order with the General Electric Company for four 2000 kw, 660-volt, 25-cycle, direct-current rotary converters with four air-blast transformers. Three of these rotary converters are to be placed in the substation at Irvington and one at Glenwood. Delivery will be made next summer. The company has also ordered from the same manufacturer two 500-kw, 250-volt Curtis turbines for the light and power plant at the new Grand Central Station. The plans of the company contemplate the complete electrification of the line to Croton, N. Y., within the next eighteen or twenty months. The *Electrical World* of Aug. 4, 1910, announced that the railroad was in the market for this apparatus.

Signal Equipment for Illinois Traction System.—H. E. Chubbuck, of Peoria, Ill., vice-president executive of the Illinois Traction System, is quoted as saying that his company has determined to spend $1,000,000, if necessary, to equip its extensive system of interurban railways with block signals. It is said that the Illinois Traction System will be the first interurban network to be entirely equipped with automatic electric block signals. The signals to be installed are to be at least equal to the best used by steam railroads and are designed to eliminate all danger of collisions.

Gasoline Electric Cars on Long Island.—It is stated that short branches of the Long Island Railroad Company will soon be equipped with gasoline electric motor cars. The Pennsylvania Railroad has been experimenting recently with these cars on one of its branches in New Jersey. The cars will be 70 ft. long and will seat ninety-one passengers.

Reduction in Cable Rates.—Clarence H. Mackay, president of the Commercial Cable Company and the Postal Telegraph Company, announced last week a reduction in cable rates which will effect a great saving on ordinary messages. Mr. Mackay said that the cable company had been for some time formulating plans by which the rates for messages sent by the general public and expressed in plain English could be reduced about one-half. A plan has now been worked out, and, if it secures the co-operation of the government land lines in Europe, it will effect a great saving. The present cable rate is 25 cents per word, and on such messages the present plan is to charge 12½ cents for every five letters, the letters being counted instead of the words. In order to make this plan operative, Mr. Mackay says that the land lines must agree to make a proportionate reduction in rates. The company has been endeavoring for a long time to get away from the use of code messages, especially those which are not expressed in ordinary words. Mr. Mackay is of the opinion that the new plan will not only be of great benefit to the outside public, but will induce business men to eliminate as far as possible the use of the code. Following Mr. Mackay's announcement, President Robert C. Clowry, of the Western Union Telegraph Company, has issued a statement to the effect that his company had been studying for a year the modification and reduction of cable rates, and had formed a tentative plan. He said that an agreement had been substantially reached as far as English transatlantic cables were concerned, but that there was some question with the British Post Office authorities owing to the rules of the international telegraph convention. He said that it now seemed probable that an agreement could be reached on a basis of half rates for plain English. This is practically the same basis as proposed by Mr. Mackay.

Cleveland to Have Subways.—It is now probable that Cleveland will continue its present three-cent fare indefinitely, the Council having decided last week not to end it with the limit of the trial period, Dec. 1, as the company is making the required 6 per cent for the stockholders and keeping the expense account squared without touching the interest fund. In the recent election Cleveland voted to approve franchises for both high and low level subways. Under the provisions of the high-level subway ordinance, construction must be started within eighteen months and subway cars must be in operation within four years. Work on the low-level system must be started within two years, and one of the tubes, from the Cuyahoga Valley through to the lake front, must be in operation in four years. The various upper-level subways throughout the city aggregate between thirty-five and forty miles in length. The city can at any time buy these subways back from the builders by paying $350,000 a mile, one-seventy-fifth of the value being taken off each year until the end of the seventy-five year period, when the franchises expire and the subways automatically become the city's property. The low-level subway plan contemplates about three miles of tunnels. These can be bought by the city at any time by the payment of $850,000 a mile.

Westinghouse October Orders.—The sales booked by the Westinghouse Electric & Manufacturing Company during October approximate $2,600,000, a slight increase over September. For the last three months the sales have been very close to $2,500,000 per month. This is a decrease of about 15 per cent from June and July figures. At the same time orders billed to customers during the past two or three months have been running in excess of $3,000,000 a month, and it is said that the net profits of the company since the fiscal year began, April 1, have been at the rate of almost 12 per cent on the common stock. About the first of this month the Westinghouse Electric company shipped fifteen carloads of electric apparatus, weighing almost 500,000 lb., to Valparaiso, Chile. This will be used at Rancagua, Chile, to furnish light and power for the Braden Copper Company. This company is owned by the American Smelting & Refining Company, and is one of the largest developments of its kind in South America. The shipment includes three water turbines. The various Westinghouse companies last month had the largest pay rolls in their history. The aggregate of the four principal companies was $1,500,000.

Central Colorado Power Company.—The announcement in the West that the Central Colorado Power Company had secured control of Boyd Lake, an immense storage reservoir near Greeley, Col., is officially denied. A representative of the Central Colorado Power Company says that his company has at this time no need for this reservoir and has no intention of buying it. It held an option upon the property for several years, but this option was recently surrendered, and the property is now to be developed by its present owner, Burton D. Sanborn. Mr. Sanborn is largely interested in irrigation projects in Colorado. For the purpose of development he has organized the Boyd Lake Reservoir & Irrigation Company. The fact that some of the officials of the Central Colorado Power Company are directors in this company probably gave rise to the report. The Central company is now developing about 30,000 hp and is finding a very excellent market for its energy. A contract is now being negotiated, but has not yet been signed with the Denver Gas & Electric Company.

E. E. Witherby Company.—The E. E. Witherby Company, gas, electric and street railway engineer and operator, of 40 Wall Street, announces that it has recently concluded negotiations and will at once proceed with the construction of gas-distribution systems at Westbrook and also at South Portland, Maine. Companies will be formed in these two places, which will buy their gas from the Portland Gas Light Company. The same engineering corporation has also almost completed the construction of a new gas plant at Shamokin, Pa., which will begin operations about Dec. 1. It is said that this will be one of the most up-to-date plants in the country. The engineers also announce that distribution will be begun by the South Shore Gas Company at Babylon, L. I., about Nov. 15. This plant was constructed under the supervision of these engineers.

New Haven Railroad Buys Equipment.—The New York, New Haven & Hartford Railroad Company has ordered from the General Electric Company a considerable amount of equipment through its electrical sudsidiaries. The Connecticut Company has placed the following orders: For Hartford, one 1000-kw, 600-volt, 25-cycle rotary converter; for Buckland, two 300-kw, 600-volt, 25-cycle rotary converters; for Rockville, two 400-kw, 600-volt, 25-cycle rotary converters; for Station "A," New Haven, one 400-kw, 600-volt, 60-cycle rotary converter. Accompanying all of these are orders for the necessary transformers and switchboards. The Rhode Island Company has ordered one 15,000-kw, 25-cycle, three-phase Curtis turbine, and three 2000-kw, 600-volt, 25-cycle rotary converters with three 2250-kw, three-phase air-blast transformers and switchboard.

Insulated Wire Trade.—Standard manufacturers of insulated wire are still complaining over the condition of business. They say that the fall orders have not come up to their expectations, and that prices have not regained the former basis. A representative of one of the prominent companies said: "Trade has been demoralized by the manufacturers of cheap material, who cut prices below levels that we can afford to make. We are compelled to keep up the standard of our goods, and by doing this we cannot reach the prices that some of our competitors, whom we believe use inferior materials, are now making. Orders have not been up to expectations, and the railroads, which are generally large buyers at this time, have been practically ordering nothing."

Bids for Motor Cars Requested.—H. A. Strauss, vice-president and chief engineer of the Falkenau Electrical Construction Company, Chicago, has completed plans and specifications for six motor cars for the Alton, Jacksonville & Peoria Railway Company, for which tenders are now requested. These cars will be equipped with four Westinghouse interpole motors and double-end electro-pneumatic control. They will have automatic air brakes, steel trucks, and will be 55 ft. long, with a seating capacity of forty-two.

Freeport (Ill.) Railway, Light & Power Company.—The Freeport Railway, Light & Power Company is engaged in reconstructing its combination steam and water-power electric generating station, and in rehabilitating its distribution lines and electric-railway system, the work to be completed early in 1911. The Knox Engineering Company, Chicago, is supervising the engineering features of this reconstruction.

Westinghouse Mining Hydroelectric Equipment.—The Homestake Mining Company, Lead, S, D., has placed an order with the Westinghouse Electric & Manufacturing Company for three 3000-hp, double overhung Pelton water wheels, three 2000-kw alternators, ten 667-kw oil-insulated, water-cooled transformers, two 100-kw 3-bearing motor generator sets and a complete switchboard.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Washington, D. C.; Brookhaven, Miss.; Cincinnati, Ohio; Rocky Ford, Ga.; Oroville, Cal.; Westbrook, Conn.; Atlanta, Ga.; Albuquerque, N. M.; Maricopa, Cal.; Tiburon, Cal.; Alhambra, Cal.; Vergennes, Vt.; Englehart, Ont., Can.; St. Paul, Minn.; Milan, Wash.; Warrensville, Ohio; Chase, Kan.; Oelwein, Ia., and Houston, Tex.

Hudson & Manhattan Railroad Company.—The tunnel system of the Hudson & Manhattan Railroad Company was opened last week as far north as Thirty-third Street in New York City. The new extension is about one-half mile long, and the cost of constructing it was about $3,000,000. In the reports given out by the company the percentage of increase in the number of passengers carried in September was 23.19 and in October 24.65.

Financial.

The Week in Wall Street.

IMMEDIATELY after the election the Wall Street market started upon a rapid decline and entered a period of weakness which lasted for four or five days. On the first day after the election liquidation was very heavy and pressure to sell broke prices several points. After that the market was rather dull, but, while still weak, recorded no severe declines. At the present time the market is largely made up of speculators, and the shrewder of these had accumulated long lines of stocks several weeks ago. Feeling confident of the outcome of the election, they were prepared to put them on the market if there was any rush to buy immediately after their anticipations had been realized. For this reason offerings were very heavy on the day after election, and buyers were reasonably scarce. If any traders made money when the result of the election turned out to be what Wall Street had predicted, it was those traders who bought early and sold before the voting began. The market on Nov. 14 strengthened up a bit and recovered about half of its previous losses upon most of the active issues. Even with this recovery, however, there was very little virility to the buying movement. Except for the poor showing in the reports of orders made by the United States Steel Corporation, there is no news feature in sight to depress the market especially. The money complications in Europe are practically over, and money in this market is as easy as could be expected at this period. Rates Nov. 14 were: Call, 2½ @ 3½ per cent; 90 days, 4¾ @ 5 per cent. The quotations in the table are those of the close Nov. 14.

NEW YORK.

	Nov. 5.	Nov. 14.	Shares Sold.		Nov. 5.	Nov. 14.	Shares Sold.
All.-Ch.	9¾	9⅞*	100	Int.-Met., pf.	58⅞	56½	28,400
All. Ch., pfd.	34¼	31*	950	Mackay Cos..	95	93*	439
Amal. Cop...	71¼	69½	74,600	Mackay C.,pf.	75½	74½*	300
Am. D. T...	20½*	20½*	———	Man. Elev...	143	141*	1,800
Am. Loco....	40	39¼	2,400	Met. St. Ry..	15*	15*	———
Am. Loc.,pfd.	106½	106	170	N.Y.&N.J.Tel.	139¼	139¼*	———
Am. Tel. & C	84*	84*	———	Steel, com..	81	78⅞	992,600
Am. T. & T..	142⅞	141⅞	12,660	Steel, pfd....	118½	117⅜	16,416
B. R. T.....	77¾	76⅞	15,820	W. U. T....	73	71	2,400
Gen. Elec....	154⅞	153½	2,450	West'h, com..	73½	71	6,800
Int.-Met. ...	22⅜	21¼	15,820	West'h, pfd..	124	124*	———

PHILADELPHIA.

	Nov. 4.	Nov. 14.		Nov. 4.	Nov. 14.
Am. Rys.....	43*	43*	Phila. Elec.....	15⅜	15½
Elec. Co. of A....	11¾	11¾*	Phila. R. T.....	15½	16
Elec. St. B'ty.....	49½	47½	Phila. Trac.....	81	82
E. S. B'ty, pfd....	30*	30*	Union Trac.....	39	39¼

CHICAGO.

	Nov. 4.	Nov. 14.		Nov. 4.	Nov. 14.
Chi. City Ry.....	170*	170*	Chi. Tel. Co.....	123	122*
Chi. Rs., Ser. 1.....	76	76*	Met. El. Co.....	21*	21*
Chi. Rs., Ser. 2.....	20¼	20¼	Met. El., pfd.....	65*	63½*
Com. Edison.....	116	116	Nat'l Carbon.....	143*	125*
Chi. Subways.....	5*	4¾	Nat'l Car., pfd.....	123*	118¾

BOSTON.

	Nov. 4.	Nov. 14.		Nov. 4.	Nov. 14.
Am. T. & T.....	142½*	141⅝*	Mex. Tel.....	5¾*	5¾*
Cum. Tel.....	150*	150*	Mex. Tel., pfd.....	6¾*	6¾*
Edison E., Ill.....	274½*	282	N. E. Tel.....	137¼*	137
Gen. Elec.....	155½	153⅜	W. T. & T.....	18*	17*
Mass. E. Ry.....	20⅜*	20¼	W. T. & T., pfd...	90*	90*
Mass. E. Ry., pfd..	85½*	86¼			

*Last price quoted.
Shares sold for week Nov. 7 to Nov. 12.

Financial Notes.

Portland Railway, Light & Power Company.—A special meeting of the stockholders of the Portland (Ore.) Railway, Light & Power Company has been called for Nov. 28 to act upon a plan for the redemption at 105 of the $5,000,000 of preferred stock now outstanding. To accomplish this the plan provides for the increase of the common stock from $10,000,000 to $25,000,000. For each share of the present full-paid common stock and $62.50 in cash there will be issued to the holder two and one-half shares of new stock, which will be 65 per cent paid. The remaining 35 per cent will be subject to call, but these calls will be limited to not more than 5 per cent in any calendar year. If the plan is carried out, instead of having $5,000,000 preferred and $10,000,000 of common, the company will have $25,000,000 of 65 per cent paid common stock. This will mean $16,250,000 paid in. As a result the company will receive $1,000,000 in cash. A circular accompanying the proposal says that the City of Portland and the surrounding territory have grown so rapidly within the past five years that the demands upon the company for increased facilities and improved service have required the investment of large sums of capital, with the result that the earnings have been built up at a very rapid rate. The company is now developing two hydroelectric plants with a total capacity of 70,000 hp, one of which will be completed in about eighteen months and the other in three or four years.

Southern Pacific and Trolleys.—It was published in Los Angeles last week, and also in New York, that the Southern Pacific Railway Company had taken over the Pacific Electric Railway Company, of Los Angeles. The latter company has 581 miles of track and more than 1000 cars, and does a very large interurban business. At the New York office of H. E. Huntington, president of the Pacific Electric Railway Company, it was stated (Mr. Huntington being in the West) that no information with regard to this deal had been sent to the New York office. The report was generally discredited, and it was said that Mr. Huntington had publicly denied it in the Los Angeles newspapers. The Southern Pacific Railway Company is already largely interested in the Pacific Electric Railway Company, but the latter is operated independently.

Niagara Falls Power Company.—The combined income account of the Niagara Falls Power Company and the Canadian-Niagara Company for the nine months which ended Sept. 30 shows gross revenue of $1,607,537 and net revenue of $1,155,346. The total surplus at that time was $997,931. The income of the Cataract Power & Conduit Company, the controlling interest in which is owned by the Niagara Falls Power Company, showed gross earnings of $1,018,368 and net earnings of $260,900. The total surplus of this company was reported as $639,387. The earnings of the Tonawanda Power Company, 2009 shares of a total of 2500 shares of which are owned by the Niagara Falls Power Company, were gross $99,716 and net $41,378.

National Carbon Company Dividend.—Within the past few weeks the common stock of the National Carbon Company advanced from 120 to 145. This advance was attributed at the time to rumors to the effect that the General Electric Company was negotiating to take over the National Carbon Company. This report was officially denied in our issue of Nov. 10. The reason for the advance is now explained. On Nov. 9 the common stockholders of the company received checks for a special dividend of 15 per cent. This dividend was extra to the regular dividend, which is now 6 per cent. The receipt of these checks was the first intimation that many of the stockholders had that such a distribution was to be made.

Manhattan Railway Company.—At the annual meeting of the Manhattan Railway Company in New York last week Paul Morton, president of the Equitable Life Assurance Society, was elected a director to fill the place of the late Dumont Clarke. There was no discussion at the meeting relative to the financing of the $30,000,000 necessary for construction and for third-tracking the elevated lines. It is understood that all of this financing will be done by the Interborough Rapid Transit Company, the lessor of the Manhattan Railway Company.

Frederick (Md.) Gas & Electric Company.—The control of the Frederick (Md.) Gas & Electric Company has passed into the hands of the Frederick Railroad Company unless the deal is blocked by the Public Utilities Commission of Maryland. Application has been made to the commission by the railroad company for authority to issue $72,000 of preferred stock. Of the proceeds of this sale $32,000 is to be used to pay for recent track extensions and $40,000 for acquiring a majority of the Gas & Electric stock.

Washington, Baltimore & Annapolis Reorganization.—The members of the reorganization committee of the Washington, Baltimore & Annapolis Electric Railway Company have agreed upon a plan for reorganizing the property and lifting the receivership. Under the proposed plan the stock is reduced from $5,783,000 to $3,000,000 and the holders are required to pay $500,000 in cash, which is in the nature of an assessment, but for which they receive $500,000 in new 6 per cent non-cumulative preferred stock and $2,500,000 in common stock. Holders of the second mortgage 5 per cent bonds are asked to surrender them and receive in exchange $400,000 of new preferred stock in full settlement for both principal and interest accrued up to March 1, 1911. Whether foreclosure will be resorted to will depend upon how the plan is received by bondholders, but as more than 83 per cent of the terminal bonds and approximately three-quarters of the first-mortgage and terminal second-mortgage bonds already have been deposited, the plan probably will be successful. The new capitalization will be as follows: First-mortgage bonds, $7,500,000, of which $5,000,000 will be issued; 6 per cent non-cumulative preferred stock, $2,500,000, of which $1,460,000 will be issued, and common stock, $3,000,000, all of which is to be issued.

Montreal Street Railway Company.—Explanations as to the reason why the old board of directors of the Montreal Street Railway Company made no contest to retain control at the recent meeting, which fact was referred to in our issue of Nov. 10, are now coming forward in Canada. It is said that not a single member of the old board considered the stock of the company worth to them the $250 a share that the Canadian Light & Power Company interests were willing to pay for it. For this reason they did not come into the market to buy a sufficient number of shares to retain control. The Montreal Light, Heat & Power Company, which for a time appeared willing to pay this price for the stock, had called off its prospective deal a few weeks previous to the annual meeting. The Canadian Light & Power Company management was willing to pay more for the property in order to secure a market for its large amount of surplus energy. The Canadian Light & Power Company is now generating about 22,000 hp, and has prospective developments which will add greatly to this output.

Toronto & Mimico Railway.—The Etobicoke Township Council at a meeting on Nov. 7 passed a resolution authorizing negotiations being entered into with the City of Toronto looking toward taking over the Toronto & Mimico Electric Railway Company's system by the city when the company's franchise expires on Jan. 23, 1912. The line was constructed in 1891 under a twenty-year franchise granted to the Toronto & Mimico Electric Railway Company, which was merged some years ago with other radial lines running north and east from Toronto into the Toronto & York Radial Railway Company, the whole of whose capital stock is owned by the Toronto Railway Company.

Allis-Chalmers Re-elects Officers.—At the meeting of the Board of Directors of the Allis-Chalmers Company following the annual stockholders' meeting the old officers of the company were re-elected. These are: E. H. Gary, chairman of the board; W. H. Whiteside, president; L. F. Bower, first vice-president; Henry Woodland, second vice-president and treasurer; W. W. Nichols, third vice-president and secretary; W. A. Thompson, comptroller; M. C. Miller, assistant to president, and M. W. Babb, general attorney and assistant secretary.

British Columbia Electric Railway Agreements.—The British Columbia Electric Railway Company has submitted a proposal through Assistant General Manager Glover covering the consolidation of all the operating agreements with the cities of Hastings, South Vancouver and Point Grey in case these districts should be annexed to the city and a Greater Vancouver formed. The company proposes that the different agreements shall be consolidated into a new agreement running for twenty-five years, in return for which an increased percentage on earnings will be paid to the city.

DIVIDENDS.

American Railways Company, quarterly, 1½ per cent, payable Dec. 15.

American Telegraph & Cable Company, quarterly, 1¼ per cent, payable Dec. 1.

Chicago Telephone Company, quarterly, 2 per cent, payable Dec. 31.

General Electric Company, quarterly, 2 per cent, payable Jan. 14.

Kansas City Railway & Lighting Company, preferred, quarterly, 1¾ per cent, payable Dec. 1.

Laclede Gas Company, preferred, semi-annual, 2½ per cent, payable Dec. 15; common, quarterly, 1¾ per cent, payable Dec. 1.

Mobile Electric Company, preferred, quarterly, 1¾ per cent, payable Nov. 15.

Philadelphia Electric Company, quarterly, 1½ per cent, payable Dec. 15.

St. Joseph (Mo.) Railway, Light, Heat & Power Company, quarterly, 1¾ per cent, stock dividend, 35½ per cent, both payable Nov. 15.

West Penn Traction Company, semi-annual, 1 per cent, payable Dec. 15.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Baton Rouge Electric Company:					
September, 1910	$8,881	$6,137	$2,774	$1,945	$799
September, 1909	8,249	4,965	3,285	1,951	1,334
Cape Breton Electric Company, Ltd.:					
September, 1910	28,835	13,113	15,722	6,148	9,574
September, 1909	25,890	13,267	12,623	6,281	6,342
Columbus (Ga.) Electric Company:					
September, 1910	39,236	16,710	22,526	17,908	4,618
September, 1909	31,604	18,329	13,275	12,711	564
Edison Electric Illuminating Company of Boston:					
October, 1910	427,636	183,855	243,781	.....	.....
October, 1909	397,586	187,403	210,183	.....	.....
Edison Illuminating Company of Brockton:					
September, 1910	25,702	14,583	11,119	4,727	6,392
September, 1909	22,365	13,511	8,854	3,646	5,208
El Paso Electric Company:					
September, 1910	54,846	31,383	23,463	8,216	15,247
September, 1909	50,501	29,874	20,627	8,185	12,442
Houghton County (Mich.) Electric Light Company:					
September, 1910	21,558	10,489	11,069	4,553	6,516
September, 1909	20,645	10,070	10,575	4,266	6,309
Jacksonville Electric Company:					
September, 1910	45,995	27,156	18,839	9,451	9,388
September, 1909	38,375	20,807	17,568	9,522	8,046
Lowell Electric Light Corporation:					
September, 1910	34,303	19,868	14,435	4,853	9,582
September, 1909	29,187	14,823	14,364	6,761	7,603
New England Telephone & Telegraph Company:					
Year ended June 30, 1910	12,225,332	8,885,418	3,339,914	120,531	3,522,436
Year ended June 30, 1909	11,031,289	8,307,473	2,724,816	161,035	2,823,786
Paducah Traction & Light Company:					
September, 1910	21,251	11,264	9,987	7,126	2,861
September, 1909	21,649	12,828	8,821	4,335	4,486
Puget Sound Electric Company:					
September, 1910	160,545	98,608	61,937	51,973	9,964
September, 1909	179,956	107,605	72,351	48,552	23,799
Savannah Electric Company:					
September, 1910	51,598	32,606	18,992	18,157	835
September, 1909	49,523	32,031	17,492	17,444	48
Sierra Pacific Electric Company:					
September, 1910	47,544	14,325	33,219	6,020	27,199
September, 1909	45,232	13,317	31,915	5,860	26,055
Tampa Electric Company:					
September, 1910	44,969	23,910	21,059	6,018	15,041
September, 1909	47,108	27,253	19,855	4,615	15,240
United Railway Company of St. Louis:					
September, 1910	965,943	642,182	329,781	233,233	96,548
September, 1909	924,993	589,357	339,971	232,132	107,839

General News

Construction News.

BIRMINGHAM, ALA.—It is reported that the Tidewater Railroad Company will begin work on its proposed railway within sixty days, provided the City Council grants the extension of the city franchises asked for by the company. Work will first begin on the construction of the railway between East Lake and Bessemer, a distance of forty-six miles, after which the main line to Tuscaloosa will be built. The cost of the work within the Birmingham city limits will approximate $2,500,000 and include freight and passenger terminals. J. M. Dewberry is president.

BIRMINGHAM, ALA.—Application has been made to the City Council by the Alabama Railway & Electric Company for a franchise to construct and operate an electric railway over certain streets in the Wylam section of Birmingham to extend from the western terminus of the Wylam line of the Birmingham Railway, Light & Power Company to the new No. 13 coal mine of the Tennessee Coal, Iron & Railroad Company. If granted a franchise work will begin on the proposed railway in the near future. R. W. Snyder, Max Blach, Joseph Martin, and W. W. Crawford are among the incorporators.

OPELIKA, ALA.—The contract for pole-line materials, including wire, cross-arms, insulators, etc., for the new street lighting system has been awarded to the Wesco Supply Company, of Birmingham, Ala., for $4,862.

SELMA, ALA.—It is reported that the Tennessee Chemical Company's new fertilizer plant will be equipped for electrical operation. Electricity for operating the plant will be supplied by the Selma Lighting Company.

BISBEE, ARIZ.—Extensive improvements are contemplated by the Tri-State Telephone Company in this district, which will involve an expenditure of about $25,000. Work will soon begin on the erection of a copper circuit and rebuilding of the toll lines between Bisbee and Naco.

KINGMAN, ARIZ.—The Desert Power & Water Company is making improvements to its plant at a cost of about $75,000. The output of the plant will be doubled and one of its transmission lines extended about six miles.

MIAMI, ARIZ.—Extensive additions are being made to the plant of the Miami Copper Company, including the installation of a new concentrator and a large pumping station, operated by electricity, located three miles distant. It is understood that the company will be in the market for equipment in connection with this plant at intervals for some time to come.

HEBER SPRINGS, ARK.—Cyrus F. Crosby, of Heber Springs, Ark., is reported to be in the market for electrical equipment for an $18,000 hotel.

ALHAMBRA, CAL.—Bids will be received until Nov. 26 by Peter T. Anderson, secretary board of trustees, Alhambra City School District, for one 6-hp, horizontal gas engine, standard make; one 2¾-kw generator, to supply 50 lamps, standard make; same to be installed with all necessary pulleys and belting at the Ramona School, the High School, Garfield Avenue School and the Marengo Avenue School.

ANDERSON, CAL.—Five carloads of machinery consigned to the Northern California Power Company have arrived at Anderson, which will be hauled by traction engines to the new power plant of the company, located at Coleman, on Battle Creek, five miles from Ball's Ferry. It is expected to have the plant in operation by next June. The plant will have a generating capacity of about 16,000 hp and will increase the total output of the company to 47,000 hp.

BAKERSFIELD, CAL.—The San Joaquin Light & Power Company expects to have its new substation, located at Twenty-fourth Street and Union Avenue, ready for operation soon. The station will be equipped with a 750-kw generator and Curtis turbine with boilers and other auxiliaries, which will increase the output of the company by 1000 horsepower. Another 200-kw. generator will be installed in the substation within two months.

CHICO, CAL.—It is reported that plans are being considered to enlarge and extend the power plant of the Sacramento Valley Power Company in Chico. Charles Leege, of San Francisco, president of the Central Traction Company, is interested in the company.

FRESNO, CAL.—Preparations are being made by the San Joaquin Light & Power Company to begin work on the erection of its transmission lines from Fresno through the oil fields to Bakersfield, Cal., early in November. It is proposed to run a loop from the plant near Fresno through the oil fields by the way of Bakersfield, returning through Coalinga. The work will begin simultaneously at Fresno and at Bakersfield and will not be completed until next spring. The company is also planning to extend its transmission lines from Fresno to the King's River rock crushing plant, located at the end of the Santa Fe extension line, now under construction. A. G. Wishon is general manager.

LODI, CAL.—Plans have been prepared by H. H. Henderson, city engineer, for the erection of a new municipal electric plant in Lodi. It is understood that plans have been approved and bids will be called for in the near future.

LOS ANGELES, CAL.—Preparations are being made by the Los Angeles-Western Railway Company for the construction of an electric railway between Hermosa Beach and Culler, for which, it is said, rights of way have been secured.

MARICOPA, CAL.—Surveys are being made for the Pine Mountain Water Company for the construction of a large water main from the headquarters of the Quyama, near Ozena, into the West Side fields, just back of Maricopa, for the purpose of supplying water to the towns of the West Side oil fields. The water line will be about forty miles in length. The water will be used also to generate electricity for use in the fields as well as for domestic purposes.

OROVILLE, CAL.—Notice of appropriation of 40,000 miner's in. of water in French Creek has been filed by O. M. Enslow, of Berkeley, Cal., engineer, to be used for power purposes. A dam 100 ft. high and 600 ft. long at its crest will be built, and the water carried by a flume to the proposed plant.

OROVILLE, CAL.—Notice of appropriation of 20,000 miner's in. of water in the middle fork of Feather River has been filed with the State Engineer by H. L. Gradon, of Thermalito, Cal., civil engineer, to be diverted by a dam about one-fourth of a mile below Brush Creek and carried by tunnel, flume and ditch, to be used for irrigation and power purposes.

OROVILLE, CAL.—It is reported that plans are being considered by the Great Western Power Company for the development of a large power project, for which preliminary surveys are being made. The project includes the construction of a tunnel, four miles in length, from Bartees Bar to Big Bar, on the north fork of the Feather River. The cost of construction of the tunnel is estimated at $10,000,000.

PORTOLA, CAL.—Plans are being considered for the installation of an electric lighting plant and water works system in Portola. W. J. Crawford, I. G. Lane and Charles T. Tyre have located 40,000 in. of water on Grizzley Creek, about three miles above Portola, where it is proposed to locate a power plant and pipe the water into the city. Work will begin immediately on construction of the dam. A temporary plant will be installed at once and will probably be ready to put in operation the latter part of December.

SANTA ROSA, CAL.—Application has been made to the City Council by Fred J. Bertolani to erect a fireproof building in the rear of the Bismarck restaurant, which will be equipped with an electric generator and gasoline engine. The proposed plant will furnish electricity for 1000 lamps of 16 cp.

TIBURON, CAL.—Bids will be received until Dec. 3 at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing and installing at the United States Navy Coal Depot, Tiburon, Cal., two boilers, one boiler feed pump, steel stack, motor generator set, one transformer, switchboard, wiring, piping, etc., and installing a generating unit to be furnished by the government, as per specifications No. 1756. The cost of the work is estimated at $25,000.

COLORADO SPRINGS, COL.—The City Council has passed an ordinance requiring all electric wires to be removed from Tejon Street within six months.

DENVER, COL.—The Primos Mining & Milling Company is installing a steam auxiliary steam power plant at the Primos Mill in Lakewood. The company is constructing a large hydroelectric power plant near Nederland in Boulder Creek, where about 1100 horsepower will be developed to supply electricity for the two mills of the Primos company and for its proposed railway and other industries. The company has secured the right of way and has purchased locomotives for a tram, about twelve miles in length, to connect the mines and mills with the Denver, Boulder & Northwestern Railroad.

GUNNISON, COL.—It is reported that plans and specifications are being prepared by Burns & McDonnell, Kansas City, Mo., for improvements to the municipal electric light and water works plants. It is proposed to develop the water-power of the Gunnison River to operate both plants.

LA JUNTA, COL.—The Pueblo Suburban & Traction Company has purchased the controlling interest in the La Junta Electric Company, of La Junta, Col. It is understood that improvements will be made to the system, including a reorganization of the distributing system and other changes.

PUEBLO, COL.—The city is installing about three miles of conduit and nine miles of cable in connection with the underground fire alarm telegraph system in Pueblo.

WINTERS, COL.—Plans are being made to build additional lines and improve the Farmers' telephone system, which is operating in the vicinity of Winters, in Yolo and Solano Counties.

TIVERTON, CONN.—The Tiverton Electric Light Company has applied to the Town Council for a franchise to erect electric transmission lines on the streets and highways of Tiverton. D. H. Kimball is superintendent.

WESTBROOK, CONN.—W. J. Neidlinger, who recently purchased the old Chapman mill property, is contemplating the installation of an electric light plant to supply electricity for lighting the town and shore.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the superintendent of the State, War and Navy Department Building, Washington, D. C., until Dec. 13 for installing an electric system for the State, War and Navy Department Building. Plans and specifications for the above work will be furnished upon application, for which a deposit of $100 will be required which will be refunded upon return of the plans in good condition. Lieut. U. S. Grant, third, is superintendent.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 22 for furnishing at the navy yards and naval stations supplies as follows: Puget Sound, Wash., Schedule 3029, 2550 lb. of seamless copper tubing. Bids will also be received at the same place until Nov. 29 as follows: Mare Island, Cal., Schedule 3048, 2500 ft. steel tubing; twelve motor end drills. Newport, R. I., Schedule 3051, two turbine generator sets and two motor generator sets. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—The commissioners of the District of Columbia are considering the question of installing an electric plant to supply electricity for lighting the streets and public buildings in the District of Columbia. It is proposed to develop the water-power of Great Falls in the Potomac River, about fifteen miles above Washington, D. C., where it is estimated that about 6400 hp could be developed without storage of water and 8650 hp with such storage. An approximate cost of the plant, including hydraulic and electric plants, power houses, transmission lines, conduits, lamps, etc., is estimated at $3,764,900. An appropriation of $10,000 will be asked for making surveys, etc. The cost of street lighting for the District of Columbia is about $500,000 per year.

JACKSONVILLE, FLA.—The City Council is considering the question of requiring all companies using electric wires to place them under ground. It is proposed to allow three years to put the wires under ground in the business district and five years in the surrounding section.

AMERICUS, GA.—At the election held Nov. 8 the proposition to issue $65,000 in bonds for the construction of an electric light plant and other municipal improvements was defeated.

ATHENS, GA.—The installation of an ornamental lighting system in the business district in Athens is under consideration. It is understood that the business men will install the lamps and the Athens Railway & Electric Company will supply electricity for operating the system.

ATLANTA, GA.—The Solomon-Norcross Company, engineers, has been engaged to take charge of the installation of an electric light plant at the Fulton County almshouse.

ATLANTA, GA.—The Blue Ridge Power Company, incorporated in Hall County, has applied to the State Railroad Commission for permission to issue $50,000 in capital stock and $1,375,000 in bonds.

ATLANTA, GA.—Application has been made to the State Railroad Commission by the Wofford Shoals Light & Power Company for permission to issue $70,000 in capital stock and $100,000 in bonds. The company is located in Habersham County, Ga.

ATLANTA, GA.—The Georgia Power Company has applied to the State Railroad Commission for authority to issue $10,000,000 in bonds and $10,000,000 in common stock, the proceeds to be used for the development of a number of properties on the Chattahoochee River, and also on the Etowah and Tallulah Rivers. Application was also made for permission to issue $1,370,000 in bonds and $50,000 in capital stock for the Blue Ridge Electric Company. It is stated that this company is to be a holding company for the Georgia Power Company, and as the development of the latter company goes forward the bonds isued by the Blue Ridge Electric Company will be paid off and the properties pass into the hands of the Georgia Power Company. The company states that a contract has been awarded for the first development to be completed by July 1, 1912, and that others are to follow at periods of about eighteen months. C. Elmer Smith is president of the company.

CAIRO, GA.—It is reported that the question of enlarging the municipal electric light plant is under consideration.

DOUGLASVILLE, GA.—The proposition to issue $20,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant, will be submitted to a vote at an election to be held Nov. 28.

MACON, GA.—The Brown Wagon Company has entered into a contract with the Central Georgia Power Company to supply electricity to operate its plant.

MONTICELLO, GA.—Contracts have been awarded for machinery for the Jasper Cotton Mill for a 10,000-spindle plant, which will be equipped for electric motor drive.

MOULTRIE, GA.—Arrangements are being made for the installation of a 200-hp engine and 100-kw generator with switchboard, etc., in the municipal electric plant, for which, it is said, contract for machinery has been awarded.

ROCKY FORD, GA.—Plans are being prepared by D. G. Zeigler and C. E. Maynard, of Rocky Ford, Ga., for the proposed power development of the Ogeechee River Electric Power Company, which will include the construction of three reinforced dams and three power houses, all to be of reinforced concrete construction, to be equipped with water wheels, gates, governors, generators, switchboards, transformers, wiring and electric cranes. The cost of the entire work is estimated at $1,200,000.

CHARLESTON, ILL.—Marshall E. Sampsell, president of the Central Illinois Public Service Company, of Mattoon, Ill., has submitted a proposition to supply electricity to operate the pumping station of the water works system at a saving of from $1,500 to $2,000 per year. The plan proposed by Mr. Sampsell calls for the erection of a standpipe, having a capacity of 200,000 gal. of water, in the central part of Charleston and the erection of a power station on the river and the installation of two sets of pumps, one set to be held for emergencies.

EDWARDSVILLE, ILL.—The City Council has passed an ordinance authorizing a contract with the Madison County Light & Power Company tor street lighting for a term of ten years.

GARY, IND.—The construction of an electric railway to connect Gary, Chesterton and Whiting is said to be under consideration. C. H. Geist is reported to be interested in the project.

GOSPORT, IND.—The Gosport Electric Company, it is reported, will soon ask for bids for the construction of an electric light plant. Charles Abraham is secretary.

INDIANAPOLIS, IND.—Steps will be taken to introduce a bill in the next Legislature allowing cities throughout the State to own and operate their own water and electric light plants and to issue bonds on such plants.

LADOGA, IND.—The W. F. Epperson Circle Heating & Lighting Company, of Ladoga, Ind., has changed its name to the Ladoga Light Company.

MONTICELLO, IND.—The Monticello Electric Company is reported to be preparing plans for the construction of a new power plant in the spring.

RUSHVILLE, IND.—The contract for installing new boilers in the municipal electric light plant has been awarded to the Heine Safety Boiler Company, of St. Louis, Mo., for $11,068.

DAVENPORT, IA.—The Tri-City Railway Company has commenced work on the extension of its Twenty-seventh street line in Davenport.

FORT MADISON, IA.—Arrangements are being made by the Keokuk & Hamilton Water Power Company to begin work on installation of a second plant above Fort Madison.

LOGAN, IA.—Preparations are being made by the Bullock Public Service Company to extend its telephone line from Logan to Magnolia.

MANCHESTER, IA.—The Delaware County Telephone Company is replacing the original old Farmers' Mutual telephone lines near Ryan with its own system. These lines were constructed several years ago by individuals forming companies and building their own private lines.

OELWEIN, IA.—The plant and holdings of the Oelwein Light, Heat & Power Company are reported to have been purchased by R. W. Saunders and others, of Chicago, Ill. It is understood that the new owners will erect a new power house and install a curb system of lamps.

SEYMOUR, IA.—Preparations are being made to rebuild the municipal electric light plant, which was recently destroyed by fire.

CHASE, KAN.—The City Council has engaged J. Kent White, electrical engineer, to prepare plans and specifications for an electric light plant and water works system. The cost of the plant is estimated at $20,000.

COLDWATER, KAN.—Plans for the installation of an electric light plant and water works system in Coldwater have been prepared by the J. S. Worley Company, of Kansas City, Mo., consulting engineer.

STAFFORD, KAN.—Plans have been prepared by the J. S. Worley Company, of Kansas City, Mo., consulting engineer, for improvements to the electric light plant and water works system in Stafford.

LEXINGTON, KY.—The Lexington Interurban & Street Railway Company is reported to be contemplating the construction of an electric plant, at a cost of about $300,000, for which surveys are being made.

LEXINGTON, KY.—Owing to the unsatisfactory street lighting service furnished by the Lexington Utilities Company, it is said that Mayor Skain will recommend that the city grant a free franchise to some reliable company as an inducement to install an adequate electric system to supply electrical service to the city and to private consumers. The present contract for street lighting with the Lexington Utilities Company will expire in March, 1911.

LOUISVILLE, KY.—The Louisville Railway Company has applied for a franchise to build an extension of its railway in Louisville.

MIDWAY, KY.—The citizens on Nov. 8 voted to authorize the City Council to issue bonds to the amount of $6,000, the proceeds to be used for the purpose of establishing an electric light plant in Midway.

BALTIMORE, MD.—It is reported that plans are being prepared by Dietrich Brothers, 346 North Street, Baltimore, Md., for the erection of a structural shop on the block bounded by Pleasant and Davis Streets, which will include the erection of three buildings. The equipment will include two electric cranes, of from 15 to 20 tons capacity, with a 55-ft. span.

BOSTON, MASS.—Sealed bids will be received by Louis K. Rourke, Superintendent of Streets, Room 47, City Hall, Boston, Mass., until Dec. 24, for lighting the streets of the city for a period of ten years from Jan. 31, 1911, bids to be based on furnishing approximately 10,000

lamps distributed in such separate districts as may be determined by the city, as follows: A—Furnishing and maintaining approximately 10,000 incandescent electric lamps in addition to the incandescent lamps now maintained under the existing electric lighting contract, or for the extension of the existing electric contract for a term of ten years from Jan. 31, 1911. Items B, C, D and E each call for the installation and maintenance of 10,000 gas lamps with incandescent mantle burners. Items A, B and C to also include the maintenance of approximately 210 fire alarm signal lamps. The city will supply the lamp posts.

COLRAIN, MASS.—The management of the Colrain Electric Light Company was taken over by the Greenfield Electric Light & Power Company on Nov. 1. Electricity for operating the local system will be supplied from Shelburne Falls as soon as the transmission line is completed.

GARDNER, MASS.—Plans have been completed for the construction of two new buildings for the Central Oil & Gas Stove Company at Gardner, Mass. The new plant will be equipped for electrical operation throughout.

ORANGE, MASS.—The hydroelectric plant of the Athol Gas & Electric Company at Wendell Depot has been completed. The work has been under way for a period of fifteen months and includes a large dam, new power house and bridges involving an expenditure of about $200,000. The new plant will have an output of about 1000 hp and will supply electricity to the towns of Orange, Erving, Wendell and Athol.

WOBURN, MASS.—The Board of Public Works has decided to have the street lamps burn all night instead of until 12:30 a. m. The new service went into effect Nov. 1, 1910, and will cost the town $16,519, which is about $3,403 more than the present service. The Edison Electric Illuminating Company of Boston, Mass., owns and operates the street lighting system in Woburn.

WORCESTER, MASS.—The O. C. White Power Company, 15 Hermon Street, Worcester, Mass., is reported to be in the market for a 125-hp Corliss engine.

BAY CITY, MICH.—Plans are being prepared by the Matthew Lamont Company, of Bay City, Mich., for the erection of a new factory building, 96 ft. x 154 ft., three stories high. The company, it is understood, will require power and wood-working machinery, an electric lighting system, steam heating plant, etc.

BIG RAPIDS, MICH.—The joint committee has decided to recommend to the Council that the question of purchasing the electric light plant of the Big Rapids Electric Company be submitted to a vote at an early date. It will be necessary to expend $30,000 to enlarge the power plant to operate the water works. It is proposed to have the city own its lighting plant and operate the water works by electricity.

CARO, MICH.—Plans are being made to organize a company under the name of the Detroit, Bay City & Northwestern Railway to construct an electric railway to connect Detroit, Utica, Romeo, Almont, Imlay City, Burnside, North Branch, Mayville, Caro and Bay City. From Burnside a branch will be built reaching Marlette, Bad Axe and Harbor Beach.

DAVISON, MICH.—At an election held recently the proposition to issue bonds for the installation of an electric light plant was carried.

DETROIT, MICH.—It is reported that the Detroit Edison Company is contemplating making extensive additions to its plant and system.

GRAND RAPIDS, MICH.—The Citizens' Telephone Company is planning to establish a north end branch exchange at Plainfield and Cort Avenues about Jan. 1, 1911. The equipment will cost about $8,000 and will provide for 1500 lines.

MUSKEGON, MICH.—The Muskegon Traction & Lighting Company has secured an injunction against the city preventing the sale of $75,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

PONTIAC, MICH.—The Pontiac Motor Cycle Company is erecting a large plant in Pontiac, Mich., for the purpose of manufacturing motor cycles. The company is now erecting three large buildings, one 45 ft. x 208 ft., another 55 ft. x 100 ft. and the third 55 ft. x 128 ft. The plant will be equipped for electric motor drive throughout. Robert M. Brownson is president and general manager.

BRAINERD, MINN.—Preparations are being made by the Northwest Paper Company for the construction of a new manufacturing plant, which will be equipped for electric motor drive throughout.

CANBY, MINN.—The contract for electrical equipment for use in operating sewage pumps, bids for which were opened Nov. 3, has been awarded to the Marshall Electric Company, of Marshall, Minn., for $1,268.

CHISHOLM, MINN.—The Mesaba Range Power Company, which has recently acquired the property of the Range Power Company in Chisholm, is reported to be contemplating further hydroelectric power development.

KEEWATIN, MINN.—The contract for the construction of a brick power house for the new power plant has been awarded to C. A. Kilander, of Hibbing, Minn., for $4,650, and the contract for electrical equipment to the Enterprise Manufacturing Company, of Minneapolis, Minn., for $4,264.

ST. PAUL, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, Minn., for the construction of a main engineering building and an experimental engineering building for the College of Engineering, University of Minnesota, Minneapolis, Minn., including the general contract work, plumbing work, heating and ventilating and the electrical work and fixtures in accordance with plans and specifications prepared by Clarence H. Johnston, 715 Capital Bank Building, St. Paul, Minn. Bids will be received collectively and separately, to be submitted only on form supplied by the architect. Copies of plans and specifications may be seen at the Builders' Exchange, St. Paul, Minn.; Builders' Exchange, Minneapolis, Minn.; at the office of the dean of the College of Engineering, University of Minnesota, Minneapolis, Minn., and at the office of the State Board of Control.

WINONA, MINN.—The question of establishing a municipal electric light plant in Winona is under consideration.

BROOKHAVEN, MISS.—Bids will be received by the City of Brookhaven, Miss., until Nov. 22 for one compound condensing, high-speed 200 r. p. m. Corliss valve type engine for direct connection to a 200-kva, alternating-current generator, steam consumption stated for operating ¼, ¾, 1, 1½ loads at 90 per cent, power factor, 24-in. vacuum, 140 lb. steam. Chester Byrne is city clerk.

GULFPORT, MISS.—Plans are being considered by the Pan-American Mining Company, of Gulfport, Miss., which is developing a group of mines in Mexico, for the installation of a concentrating plant in the near future to serve its various properties. It is expected that electrical power will be used throughout.

LEXINGTON, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 19 for the construction of the United States post office building at Lexington, Mo., complete, including plumbing, gas piping, heating apparatus and electric conduits and wiring, plans and specifications for which may be obtained at the above office or from the custodian of site at Lexington, Mo. James Knox Taylor is supervising architect.

BLUE HILL, NEB.—The Village Board has awarded the contract for the construction of a municipal electric light plant to the Alamo Engine & Supply Company, of Omaha, Neb., for $8,500. The plant will be driven by steam power and the equipment will include an 85-hp boiler and engine with a rating of 75 hp. The plant is to be completed in ninety days.

FREMONT, NEB.—The Fremont Gas & Electric Light Company has awarded the contract for the construction of a new power house 30 ft. x 80 ft. to Richards, Keene & Company.

VALPARAISO, NEB.—D. M. Deane, of Lincoln, Neb., is reported to have submitted a proposition to the City Council to furnish water or steam power from the Valparaiso mills to operate an electric lighting system in Valparaiso.

TONOPAH, NEV.—Arrangements are being made to install a 2-ton skip and a 100-hp electric motor at the West End mine to replace the steam hoisting equipment.

CONCORD, N. H.—The Coos Telephone Company has filed a certificate with the Secretary of State showing an increase in capital stock to $153,000.

CONCORD, N. H.—Surveys are being made by the Concord Electric Company for the erection of a transmission line from its plant at Sewall's Falls over the interval and plains, through East Concord and toward Chichester.

ALBUQUERQUE, N. M.—Investigations are being made by J. W. Billingsley, manager of the Fred A. Jones Company, of New Orleans, engineer, with a view of installing a large electric plant in the Tularosa Valley for furnishing power to pump water for reclaiming large areas of unused lands.

ALBUQUERQUE, N. M.—Plans are being made by the Federal Light & Traction Company, which controls the Albuquerque Electric Power Company, for extensive improvements to the local plant, which will involve an expenditure of about $200,000. The company proposes to furnish electricity to the farmers throughout the valley, to extend lease, or purchase lands from the American Lumber Company for power plant site, to lift the city's water supply if necesary.

ROCHESTER, N. Y.—Bids will be received by J. S. Mullan, secretary of board of education, until Nov. 21 for furnishing and installing electric lamps, wiring and fixtures for School 33, located on Grand Avenue.

ASHEVILLE, N. C.—The American Cotton Goods Company, which is planning to remove its plant from Owosso, Mich., to Asheville, N. C., has secured a building and the machinery of the company will soon arrive. The plant will be operated by electricity. D. K. Salisbury is general manager.

CASSELTON, N. D.—The plant of the Casselton Electric Light Company has been purchased by Lloyd Lynch and Chester Hallett, who, it is said, will repair and reopen the plant.

CARRINGTON, N. D.—Bids will be received by the Board of Commissioners until Nov. 28 for installing lighting fixtures for the new court house now being constructed. Buechner & Orth are architects.

CADIZ, OHIO.—We are informed that contracts have been awarded by the Wheeling, Cadiz & Tuscarawas Traction Company for the construction of its proposed electric railway, sixty miles in length, to connect Wheeling and Georgetown and intervening towns. The power station will be located about half way between the terminals. The company will also furnish electricity for lamps. The capital stock is to be increased from $10,000 to $1,200,000 and the bonded indebtedness increased to $1,200,000. A. Evans Townsend of Doylestown, Pa., is general manager.

CINCINNATI, OHIO.—The Norton Machinery Company, 610 Baymiller Street, Cincinnati, Ohio, would like to receive prices on a 100-kw, 200-volt, direct-current generator direct connected to engine.

CLEVELAND, OHIO.—The N. J. Rich Knitting Company is erecting a large factory building, 100 ft. x 360 ft., four stories high. As yet it has not been decided whether a power plant will be installed or whether power will be supplied by a commercial company.

FULLERTON, R. D. NOVELTY, OHIO.—The Fullerton Independent Telephone Company, recently incorporated, is planning to take over all the telephone lines between South Portsmouth and Tygart, and proposes to extend the line to Greenup. E. E. Fullerton, G. W. Davis and others, of Fullerton, are interested in the project.

NEWARK, OHIO.—The Newark Telephone Company has purchased a site north of North Street, on which it will erect one of the three subexchanges it proposes to build in connection with the new automatic system.

SIDNEY, OHIO.—Bids will be received by the City of Sidney, Ohio, until Nov. 21 for an electric light and power franchise in this city. S. S. Wyer, Harrison Building, Columbus, Ohio, has prepared plans for a street lighting system and drawn up a franchise grant for supplying electricity for public and commercial lighting and for power purposes.

WARRENSVILLE, OHIO.—Bids will be received at the office of C. A. Marvin, secretary of the director of public safety, No. 109 City Hall, Cleveland, Ohio, until Nov. 18, for furnishing and installing a steam and electric generating unit, switchboard and appliances for the service quadrangle, Colony Farm, Warrensville, Ohio. Plans and specifications may be seen and blank proposals can be obtained at the above office.

CHEROKEE, OKLA.—The City Council is reported to be contemplating enlarging the electric light plant and water works system.

FORAKER, OKLA.—C. A. Rees is reported to have secured the contract for an electric light system in Foraker.

OKLAHOMA CITY, OKLA.—The Bartlesville Oil Refining Company, of Oklahoma, Okla., is reported to be in the market for electrical equipment for 200 lamps.

WOODWARD, OKLA.—Judge John H. Cotteral, in the United States Circuit Court, has denied the injunction asked by the Woodward Cotton Company and has dissolved the temporary order restraining the City of Woodward from selling the bonds for the purpose of installing a lighting system. The city is now advertising the bonds for sale.

HILLSBORO, ORE.—The county court has granted the Independent Electric Company a franchise to erect transmission lines on the county road from Oak Park to Hillsboro and from Hillsboro to Orenco and Beaverton.

PORTLAND, ORE.—The property owners on Stark Street have organized the Stark Street Improvement Association for the purpose of installing an ornamental street lighting system on Stark Street from the river to Burnside Street and on the latter street as far as Washington Street.

AVONDALE, PA.—The Elk River Light, Heat & Power Company, of Newark, Del., is reported to have applied for a franchise in Avondale.

CORAOPOLIS, PA.—The citizens on Nov. 8 voted to issue bonds for improvements to the municipal electric light plant and water works system.

HAZLETON, PA.—It is reported that plans are being considered to construct an electric railway to connect Berwick, Nescopeck, Wapwallopen, Beech Haven and Hobbie. The proposed railway will connect at Hobbie with the Wilkes-Barre & Hazleton Railway of Hazleton, Pa.

HOMESTEAD, PA.—Sealed proposals will be received by D. T. Powelson, secretary of Homestead School Board, until Nov. 23, for electric wiring of the new Central School Building, and electrical fixtures for same. Bids for wiring and fixtures must be submitted separately. Plans and specifications can be secured at the office of the secretary, 303 Eighth Avenue, Homestead, Pa.

MILTON, PA.—Plans have been prepared by the Lewisburg, Milton & Watsontown Street Railway Company to extend its service to Lewisburg. It is proposed to equip the tracks of the Lewisburg & Tyrone Railroad Company for electrical operation between Montandon and Mifflinburg, a distance of ten miles, the contract for which has been awarded to the Simplex Surface Contact Company. Electricity for operating the system will be supplied from the new plant at Milton. A sub-station will be built at Vicksburg.

PEN ARGYL, PA.—The telephone lines in the Pen Argyl and Wind Gap districts were badly damaged by the recent storm, causing a loss of about $5,000; the damage to the lines in the Slate Belt district will reach about $10,000. The local service will be out of commission for about two weeks. A cable containing 100 wires will be placed on new poles to replace the old system of sixty separate wires between Pen Argyl and Wind Gap.

TACONY, PA.—The contract for the construction of the addition to the boiler house of the power plant of the Frankford, Tacony & Holmesburg Traction Company, at Tacony, has been awarded to the Charles McCaul Company.

WOODLAWN, PA.—Plans are being considered by the Jones & Laughlin Company for the construction of an electric railway to furnish better transportation facilities for its employees. The company will be known as the Woodlawn-Southern Railway Company, and the railway will form a complete circuit of approximately seven and one-half miles, passing along Franklin Avenue to the borough line in the direction of New Sheffield, over the Woodlawn-Aliquippa road to Woodlawn and above the Pittsburgh & Lake Erie Railroad from the present station to the south of the borough. It is proposed eventually to extend the railway to South Heights and possibly to New Sheffield.

SAN JUAN, P. R.—The Porto Rico Railways Company has engaged the Ambursen Hydraulic Construction Company as engineer to take charge of the construction of a dam 125 ft. high and 350 ft. long for impounding storage water for its present hydroelectric power plant, located near San Juan, work on which will commence immediately.

HIGHMORE, S. D.—A. J. Wixson, manager of the Stella Light, Heat & Power Company, of Stella, Neb., is reported to have applied for a franchise to install an electric light plant.

PIERRE, S. D.—The Nebraska Telephone Company is preparing for the extension of a copper circuit from Rapid City to Pierre and to connect with its system in the Black Hills section.

PLATTE, S. D.—F. J. Miller is reported to have been granted a franchise to purchase the local electric light plant or install a new one.

SIOUX FALLS, S. D.—The Sioux Falls Light & Power Company is making extensive additions and improvements to its plant, including the installation of boilers with a rating of 1000 hp, a main steam pipe line and feed-water heater having a capacity of 1250 hp, and the erection of a smokestack 140 ft. high. The cost of the work is estimated at $50,000.

ERIN, TENN.—The Houston Telephone Company, recently incorporated, has purchased local telephone lines, including 200 telephones. It is understood that the company proposes to improve the system, erect additional lines, and install additional exchanges. A. J. Mitchum is president.

BEAUMONT, TEX.—Lynn H. Dinkins, of New Orleans, president of the Beaumont Traction Company, has notified the City Council that the franchise recently granted the company for its proposed electric railway will not be accepted. The chief objection is the clause requiring the company to light the streets occupied by its tracks.

BROWNSVILLE, TEX.—It is reported that application will soon be made to the City Council by Theodore Stegner, of Kansas City, Mo., for a franchise to construct and operate an electric light and power plant and street railway system in Brownsville, Tex.

DALLAS, TEX.—It is reported that the Trinity Valley Traction Company, which proposes to construct an electric railway from Dallas to Palestine, Tex., 100 miles in length, will soon complete locating the route. One of the power plants will be located in Dallas. J. W. Watkins, of Dallas, is interested in the project.

DECATUR, TEX.—The local electric light plant, owned by E. H. Baumguertner, has been purchased by F. A. Mabee, who, it is said, will make improvements to the plant.

HOUSTON, TEX.—The Bay Shore Rapid Transit Company has purchased cross ties and other material for its proposed interurban railway between Houston and points on the bay shore.

HOUSTON, TEX.—The Houston Electric Company has commenced work on the extension of its Fannin Street line to Westmoreland. It expects to have the railway in operation about Dec. 1.

HOUSTON, TEX.—Arrangements have been made for the installation of a water and light plant on the Bellaire town site, located on the Westmoreland farm tract, south of Houston. The two plants will be combined and will cost about $30,000.

JOURDANTON, TEX.—C. S. Young, of San Antonio, Tex., is reported to be interested in a project to construct an electric railway from Jourdanton to Pleasanton, Tex. The railway will be known as the Bonita Valley Rapid Transit Railway.

LAMPASAS, TEX.—The plant and holdings of the Lampasas Light & Power Company have been purchased by E. Habe, owner of the Lampasas ice factory. It is understood that the two factories will be consolidated.

SAN ANGELO, TEX.—Preparations are being made by the San Angelo Telephone Company to construct underground conduits in the business district of the city.

TAYLOR, TEX.—L. E. Walker, president of the Quanah, Seymour, Dublin & Rockport Railroad Company, is interested in a project to build an electric belt railway to connect the different industrial plants and steam railroads in Taylor.

TYLER, TEX.—The Cotton Belt Railroad Company is installing an electric light and power plant in Tyler to provide electricity for lighting and operating the machinery of its shops, which have recently been erected at a cost of about $300,000.

VERGENNES, VT.—Plans have been prepared by the Vergennes Power Company for the construction of a hydroelectric power plant at Vergennes, work on which will begin as soon as the company is granted a charter by the Legislature. Parties interested in the project have purchased water rights on Otter Creek in Vergennes and propose to develop same at a cost of $75,000. The company will also erect a transmission line to Burlington at an additional cost of about $25,000. The proposed plant will supply electricity in Vergennes and Burlington and to all towns and villages along the line. Chauncey W. Brownell is one of the incorporators.

CHRISTIANSBURG, VA.—The plant and holdings of the Mont-

gomery Electrical Company, including the lighting systems in Christiansburg and Cambria, and water plant, mill, etc., at Grayson, Va., have been purchased by J. W. Glass, of Vernon Hill, Va.

VIRGINIA BEACH, VA.—The City Council is reported to be considering the question of granting a franchise for the installation of an electric light plant in Virginia Beach.

ABERDEEN, WASH.—Plans are under consideration for the construction of a telephone line from Aberdeen to Westport.

CUSICK, WASH.—Preparations are being made by M. A. Phelps & Company for the construction of a large timber-cutting plant, which will be equipped for electrical operation.

HARMONY, WASH.—The City Council has adopted plans and specifications prepared by the city electrician for the installation of an electric light plant to cost from $40,000 to $45,000.

MILAN, WASH.—Preparations are being made by the Little Spokane Water Power Company for the construction of a power plant, located about one mile south of Milan, Wash., which will supply electricity in Milan. The cost of the plant is estimated at $25,000. The company will also push the work on its irrigation project, and expects to be prepared to supply water for more than 1000 acres within a few months. The main office of the company is located in Spokane, Wash. C. M. Delamater and John T. McGirl are interested in the project.

SEATTLE, WASH.—The Seattle-Tacoma Power Company has applied to the Board of County Commissioners for a franchise to erect transmission lines on the Indian Ferry-Stuck Valley road. Morton Ramsdell is manager.

WILBUR, WASH.—The Washington Power Company, of Spokane, Wash., is negotiating with the Wilbur Electrical Company for the purchase of its plant in this place. If the deal goes through the Washington Power Company will extend its transmission line into this city.

BELOIT, WIS.—Work on the proposed new central system for the Beloit Home Telephone Company will not be started until next spring. The present plans call for the expenditure of about $100,000, of which $20,000 will be used for the construction of a new exchange building, $30,000 for a new switchboard and the remainder for placing all wires in the city in cables and installing new instruments and other changes. The company is a subsidiary of the Wisconsin Telephone Company.

BLOOMER, WIS.—The Chippewa Valley Railway, Light & Power Company, of Menomonie, Wis., it is reported, will extend its transmission lines to Bloomer to supply electricity for lamps and motors.

KENOSHA, WIS.—The Chicago Brass Company, of Kenosha, Wis., is reported to be contemplating improvements to its plant and will probably be in the market for additional electrical equipment in the near future.

MILWAUKEE, WIS.—The Wisconsin Auto Top Company, it is reported, will require some new machinery for the new addition to its factory, including electric motors.

MILWAUKEE, WIS.—It is reported that the Independent Electric Manufacturing Company, of Milwaukee, Wis., will make preparations during the winter for enlarging its manufacturing facilities and will be in the market for machine tools and other equipment.

MILWAUKEE, WIS.—The American Hydraulic Air Compressor Company, Majestic Building, Milwaukee, Wis., is reported to be contemplating the construction of a large central plant for furnishing power to manufacturing industries in the form of compressed air. A. C. Lingelbach is president.

TOMAHAWK, WIS.—It is reported that contracts will soon be awarded by the Tomahawk Pulp & Paper Company for the erection of a large new pulp mill in Tomahawk, which will be equipped for electric motor drive throughout. It is understood that it will not be necessary for the company to install a new power plant.

WAUSAU, WIS.—Plans are being considered by the Marathon County Telephone Company for the erection of eighteen miles of telephone lines next spring.

CALGARY, ALTA., CAN.—The City Council is considering the question of developing the water power of the Bow and Elbow Rivers in connection with the municipal electric plant.

CALGARY, ALTA., CAN.—Application will be made to the Dominion government for the incorporation of the Alberta Electric Railway Company, which proposes to construct railways from Calgary to Banff, from Calgary to Medicine Hat, via Grand Forks; from Coulee to Lethbridge, from Expanse Coulee to Tabier, thence westerly to Lethbridge and Long Coulee; from Thigh Hills to McLeod, from Calgary to Cariboo, thence to Knee Hill Creek; from Medicine Hat to Wood Mountain, Sask. Stuart & Lathwell, of Calgary, are solicitors.

EDMONTON, ALTA., CAN.—The City of Edmonton has engaged John S. Fielding, of Toronto, Ont., Can., to prepare plans and report on the development of the water power of Grand Rapids.

EDMONTON, ALTA., CAN.—Edmonton is endeavoring to secure co-operation with other towns and cities in this province in bringing influence to bear on the provincial government to take under its control the water-power resources of the province and to develop and operate them under the same principle as the Hydroelectric Power Commission in Ontario.

MEDICINE HAT, ALTA., CAN.—The Alberta Electric Railway Company is reported to have applied to the Dominion government for a charter to install telephone and telegraph lines, to construct and operate light and power plants, to acquire and operate coal mines and to construct and operate an electric railway to connect Medicine Hat, Calgary, Lethbridge, Banff and intermediate towns.

BRANDON, MAN., CAN.—The Brandon Electric Light Company has recently installed a central steam heating plant to supply the business district of the city with heat. The system has proven a success and will probably be extended so as to serve the entire city. E. L. Christie is president of the company.

BRANDON, MAN., CAN.—The City Council has extended the franchise of the Brandon Electric Light Company for ten years with provision that if the city at the expiration of the life of the franchise shall give one year's notice of taking the plant of the company over and does not do so the franchise will be extended for another five years.

DUNNVILLE, ONT., CAN.—The question of securing electricity from Niagara Falls through the Hydroelectric Power Commission is under consideration by the town of Dunnville. A committee has been appointed to meet the commission and private companies with a view of finding the most advantageous arrangements. The transmission lines of the Ontario Power Company and the Cataract company at present extend to Port Colborne, twenty miles distant, and the main line of the Hydroelectric Power Commission is about fifteen miles distant.

ENGLEHART, ONT., CAN.—The town has decided to develop the water power at High Falls to generate electricity to be utilized for lamps and motors in Englehart, for which debentures to the amount of $30,000 will be sold.

GUELPH, ONT., CAN.—The Robert Stewart Company is reported to be preparing plans for the construction of a new building for its plant, which will be equipped with electric-driven machinery.

GUELPH, ONT., CAN.—Niagara power was turned on in Guelph for the first time Nov. 2. The service is furnished by the Hydroelectric Power Commission and it is expected to have the system in operation soon.

RENFREW, ONT., CAN.—Arrangements are being made for the reconstruction of the power plant of the Renfrew Electric Company, which was recently destroyed by fire.

SARNIA, ONT., CAN.—In return for an extension of its franchise for a period of five years the Bell Telephone Company has agreed to erect a new exchange and install a central energy system.

STEELTON, ONT., CAN.—A by-law authorizing an expenditure of $30,000 for the construction of a lighting plant will be submitted to the ratepayers of Steelton.

TORONTO, ONT., CAN.—It is reported that the National Electric & Heating Company will remove its plant from Galt to Toronto, in the spring, where a large building is being erected for the company.

TORONTO, ONT., CAN.—The Board of Control in its report to the City Council has recommended that the Council petition the provincial government to purchase the property of the Bell Telephone Company and also advises the city to seek co-operation of the Ontario Municipal Union and other cities, towns and municipalities to this effect.

WATERLOO, ONT., CAN.—The Hydroelectric Power Commission has completed its system to Waterloo and Niagara power was turned on for the first time Nov. 2.

WOODSTOCK, ONT., CAN.—The transmission line of the Hydroelectric Power Commission has reached Woodstock, by which Niagara power will be supplied to the municipal electric plant. It is expected to have the new system in operation by the middle of the month.

MONTREAL, QUE., CAN.—It is reported that plans are being prepared by the Central Light, Heat & Power Company for the erection of a ten-story building at Notre Dame and St. Peter Streets. A portion of the site is now occupied by the power plant of the company. Finley & Spence are architects.

MAPLE CREEK, SASK., CAN.—Proposals are being asked by the Mayor and Council of Maple Creek for the installation of an electric light and power plant and construction of flour mill in Maple Creek.

ROULEAU, SASK., CAN.—J. D. Whitmore, of Regina, Sask., has been engaged to take charge of the construction of the municipal electric light plant. The proposed plant will cost about $60,000. Work on it will not begin until next year.

EL TIGRE, SONORA, MEX.—Announcement has been made that the transmission line that is being erected from the power plant of the Copper Queen Mining & Smelting Company, at Douglas to El Tigre, a distance of fifty miles, will be completed and will supply electricity for the mines and reduction mills in this section by May 1, 1911.

GUANAJUATO, MEX.—The transmission line of the Central Mexico Light & Power Company, a subsidiary of the Guanajuato Light & Power Company, which extends from the distributing station at Guanajuato to San Luis Potosi, has been completed. The line is about 200 miles in length and will supply electricity for the large smelter and other industries in San Luis Potosi and adjacent territory.

MOCTEZUMA, SONORA, MEX.—Olaf Wenstrom has applied to the federal government for a concession of water rights in the Moctezuma River. It is proposed to erect a hydroelectric power plant.

MONTEMORELOS, NUEVO LEON, MEX.—The Graybill Industrial College of Montemorelos has recently installed an electric power plant. J. R. Low is mechanical engineer of the college.

New Industrial Companies.

THE BATTER EMPORIUMS, of Buffalo, N. Y., have filed articles of incorporation with a capital stock of $50,000 for the purpose of dealing in automobiles, parts and electrical devices for same. The incorporators are: T. P. Meinhard, F. A. Johnson and G. Roleton, all of Buffalo, N. Y.

THE BLACKHAWK ELECTRICAL SUPPLY COMPANY, of Waterloo, Ia., has been organized with a capital stock of $100,000 for the purpose of dealing in electrical supplies. H. G. Rogers is at the head of the enterprise.

THE BROWN AUTOMOBILE & ELECTRIC COMPANY, of New Albany, Ind., has been incorporated with a capital stock of $10,000 by Herman W. Brown, Harry P. Brown and O. C. Thompson. The company proposes to manufacture and sell electrical appliances and supplies of all kinds, to deal in electric and gas motors and automobiles and automobile parts and appliances.

THE COX & BALL SUPPLY COMPANY, of Bainbridge, Ga., has been organized with a capital stock of $10,000 by W. C. Cox and others to deal in general machinery and electrical supplies of all kinds.

THE ELECTRIC MANUFACTURING COMPANY, of Pittsfield, Mass., has filed articles of incorporation, with a capital stock of $25,000, for the purpose of manufacturing electrical machinery. G. W. Euker is president, and J. F. MacDonald, of Pittsfield, Mass., treasurer.

THE ELECTRODE COMPANY OF AMERICA, of Niagara Falls, N. Y., has been chartered with a capital stock of $200,000 for the purpose of manufacturing electrodes and carbon articles of all kinds. The incorporators are: P. L. T. Heroult, A. Stetson and F. White, of New York, N. Y., and W. P. Marseilles, of Niagara Falls, N. Y.

THE GEORGE DRAKE SMITH COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000 for the purpose of manufacturing and dealing in all kinds of electrical apparatus. The incorporators are: Thomas H. Beardsley and George Tiernan, 54 Wall Street, New York, N. Y., and John L. Gibson, 25 West Forty-second Street, New York, N. Y.

THE LOEB ELECTRO-CHEMICAL COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by Leo Harburger, Savoy Hotel; George M. Turner, 135 Seventy-first Street; Stanley D. Brown, 163 West Seventy-first Street, all of New York, N. Y. The company proposes to manufacture chemicals, electro-plating supplies, dynamos, etc.

THE LUNDIQUIST AUTOMATIC MACHINES COMPANY, of New York, N. Y., has been chartered with a capital stock of $7,500 by Leopold Weiscopf, 30 Church Street; H. Lundiquist, 508 Pearl Street; William W. Tait, 160 Broadway, and M. E. Skerritt, 30 Church Street, all of New York, N. Y. The company proposes to manufacture automatic machinery, tools, etc.

THE LUSTER LIGHT COMPANY, of Chicago, Ill., has been incorporated by F. J. Switzer, C. C. Loder and J. A. Blume. The company is capitalized at $30,000 and proposes to manufacture electric lamps and electric appliances.

THE McCONNELL-BROWNING ENGINEERING COMPANY, of Richmond, Va., has been chartered with a capital stock of $25,000. The officers are: W. H. McConnell, president; M. J. Browning, secretary and treasurer, both of Richmond, Va., and H. R. McConnell, vice-president, of Washington, D. C.

THE MISSOURI BATTERY & LIGHTING COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $300,000 by George F. McClain, Max Morris, H. W. Darby and others.

NEW ENGLAND ENGINE & SUPPLY COMPANY, of Boston, Mass. has been incorporated with a capital stock of $50,000 by James N. Schoonmaker, Maurice W. Carsley, of Winthrop, Mass., and Walter E. Brownell, of Boston, Mass.

THE OAKLEY FOUNDRY & ENGINEERING COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 for the purpose of manufacturing and dealing in machinery, etc. The incorporators are: James G. Gregg, John T. McGovern, Clarence W. Gormley, 141 Broadway, New York, N. Y.

THE OTTO MOTOR CAR COMPANY, of New York, N Y., has been incorporated by J. J. McDonald, of New York, N. Y.; J. M. Lang and H. A. Bedell, of Brooklyn, N. Y. The company is capitalized at $50,000 and proposes to manufacture motor vehicles, motors, engines, machinery, etc.

THE ROBERTS MANUFACTURING COMPANY has been chartered by Joseph N. Kelly, Louis J. Edmonds, William H. Roberts and Elmer Wetzel. The company is capitalized at $10,000 and proposes to manufacture and deal in carburetors and other mechanical devices.

THE VICTOR MOTOR TRUCK COMPANY, of Buffalo, N. Y., has been chartered by Harry B. Clark, Olin L. Neal, Benjamin E. Neal and C. M. Miller, of Buffalo, N. Y. The company is capitalized at $250,000 and proposes to manufacture and deal in motor vehicles, engines, etc.

THE WASSON PISTON RING COMPANY, of Bayonne, N. J., has been incorporated with a capital stock of $35,000 by Foster Crampton, 60 Wall Street, New York, N. Y.; Robert B. Wason, Cranford, N. J.; Hulbert T. E. Beardsley, 45 Cedar Street, New York, N. Y., and Louis Burstein, 180 Pulaski Street, Brooklyn, N. Y. The company proposes to manufacture piston rings, piston packing, etc.

THE WILKINSON STEAM ENGINEERING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 to manufacture and deal in boilers, engines, pumps, etc. The incorporators are: James C. Hitchcock, Frederick Page, 9 Pine Street, New York, N. Y., and Wilbur B. Wilkinson, 2713 Avenue G, Brooklyn, N. Y.

New Incorporations.

MONTGOMERY, ALA.—The Alabama Traction Company has been chartered with a capital stock of $1,000,000, of which $250,000 has been issued. The company proposes to construct a twenty-five mile electric railway in Montgomery, which will eventually be extended to other towns. Material has already been ordered and work will soon begin. Electricity for operating the railway will be rented. Charles G. Abercrombie, of Montgomery, Ala., is president and general manager and John J. Flowers, of Montgomery, vice-president and treasurer.

CRISFIELD, MD.—The Crisfield Light & Power Company has been chartered with a capital stock of $50,000 by C. Owens, R. R. Layton, of Bridgeville, Del., and J. G. Gray, of Wilmington, Del.

DULUTH, MINN.—The Mesaba Electric Railway Company has been incorporated with a capital stock of $50,000 and proposes to construct electric railways in St. Louis, Itasca and adjoining counties. The officers are Oscar Mitchell, president; W. D. Bailey, vice-president, and F. M. Emanuelson, secretary and treasurer.

CENTRALIA, MO.—Articles of incorporation have been filed for the Centralia Light & Power Company by R. H. Baldridge, S. M. Locke and E. R. Locke. The company is capitalized at $50,000 and is constructing a transmission line fourteen miles in length to connect with the plant of the Mexico Power Company at Mexico, Mo.

ATLANTIC CITY, N. J.—Articles of incorporation have been filed for the National Water Power Company by Walter H. Fierce, John W. Fierce and Malvin Beyer, all of Atlantic City, N. J. The company is capitalized at $500,000.

NEW YORK, N. Y.—Articles of incorporation have been filed for the Gotham Electric Company, of New York, N. Y., with a capital stock of $10,000 by Robert Lecouvre, 51 Vesey Street; Richard C. Fitzgerald and James E. Siers, 48 New Street, all of New York, N. Y. The company proposes to construct and operate telephone and telegraph wires.

WILLIAMSVILLE, N. Y.—The Board of Village Trustees is reported to have granted a franchise to George E. De Galia, of Buffalo, N. Y., to supply electricity in Williamsville.

WELLSVILLE, OHIO.—The Yellow Creek Telephone Company has been incorporated with a capital stock of $1,000 by Robert Boyd, Lawrence Boyd, Homer Faloon, S. J. Jarvis and C. G. Swearengen.

CALUMET, OKLA.—The South Calumet Telephone Company has been incorporated with a capital stock of $5,300 by Frank Hornberger, W. F. Reidener and H. O. McGowan.

PORTLAND, ORE.—Articles of incorporation have been filed for the Central Oregon Irrigation Company with a capital stock of $1,050,000. The new company is a reorganization of the Deschutes Irrigation & Power Company and controls 17,000 acres of land to which water for irrigation has been conducted and 150,000 acres yet to be irrigated. The company proposes to have this large tract of land available for settlement within two years and will secure from $600,000 to $700,000 in additional funds to proceed with the work. The officers of the company are F. S. Stanley, of Portland, Ore., president; A. F. Bliss, vice-president, and Jesse Stearns, of Portland, secretary and treasurer.

HARRISBURG, PA.—Charters have been granted by the Secretary of State to the Glendon Power Company, the West Eaton Power Company and the Williams Power Company. Each company is capitalized at $5,000 and the directors are: Bruce S. Lachlan, of Plainfield, N. J., treasurer; William P. Bray, of East Bangor, Pa.; E. W. Evans, of Easton, Pa., and Edwin C. Weller, of Portland, Pa.

HARRISBURG, PA.—Application has been made to the State Department for charters for eighteen new companies as follows: The Edison Electric Light Company, of Boyertown, Oley Township, Lower Alsace Township, Exeter Township, Earl Township, Douglass Township, Colebrookdale Township, Amity Township, Berne Township, Edison Birdsboro, Edison Pottstown, Lower Pottsgrove, Muhlenbert Township, Ontelaunee Township, Robeson Union Township, Upper Pottsgrove and West Pottsgrove Township. Each company is capitalized at $5,000 and the incorporators are: Walter A. Rigg, George L. Roller, Harry H. Reigel, all of Reading, Pa. It is understood that after the charters are issued all the companies will be merged into one company and the entire territory served by one plant.

MAYESVILLE, S. C.—The Mayesville Telephone Company has been granted a charter with a capital stock of $1,750. The officers are: H. J. Harby, president; G. A. Lemmon, vice-president, and Robert Shelor, secretary and treasurer.

BAY CITY, TEX.—The Bay City Ice & Light Company has been chartered with a capital stock of $25,000 by C. G. Foulks, W. M. C. Foulks and John M. McCorbett.

JASPER, TEX.—Articles of incorporation have been filed for the Jasper Electric Company with a capital stock of $5,000 by H. C. Howell, J. H. Seale and O. M. Stone.

JANESVILLE, WIS.—Articles of incorporation have been filed for the Janesville Traction Company with a capital stock of $125,000. T. S. Nolan, who recently purchased the property of the Janesville Street Railway Company at public auction, is one of the incorporators. William Murphy, of Janesville, is also interested in the company. The company proposes to build new interurban railways into the territory surrounding Janesville.

Personal.

MR. HENRY L. DOHERTY will present a paper on "Rates" at the annual convention of the National Commercial Gas Association, to be held in Boston Dec. 5-9.

MR. W. L. ABBOTT, chief operating engineer of the Commonwealth Edison Company, Chicago, was re-elected as a trustee of the State University of Illinois at the election of Nov. 8.

MR. S. W. BORDEN has resigned from the staff of the Tuxedo (N. Y.) Electric Light Company to become electrical superintendent of the Commonwealth Water & Light Company, Summit, N. J.

MR. WILLIAM J. CLARK.—The marriage is announced of Mr. William J. Clark, manager of the traction department, General Electric Company, to Miss Blanche A. McCollum, of Lockport, N. Y.

MR. THOMAS W. WILKINSON, formerly with the Missouri and Kansas Telephone Company and the Auburn Telephone Company, has been appointed superintendent of the Emporia (Kan.) Telephone Company.

MR. W. B. KOUWENHOVEN, instructor in physics and electrical engineering at the Polytechnic Institute, Brooklyn, has received leave of absence to take a post-graduate course at the Grossherzogliche Technische Hochschule at Karlsruhe, Germany.

MR. CYRIL NAST, of the New York Edison Company, was married on Nov. 12 to Miss Marie Annette Serre, daughter of Dr. and Mrs. Jules Emile Serre, of Brooklyn. Mr. Nast has charge of the publicity work of the New York Edison Company and is the son of the late Thomas Nast, the gifted and celebrated cartoonist and lecturer whose work on *Harper's Weekly* during the Civil War and after will long be remembered.

MR. ROBERT McCORMICK, president of the board of trustees of the Sanitary District of Chicago, was defeated for re-election by Mr. Thomas A. Smythe on Nov. 8. Mr. McCormick made a study of the sale of electrical energy during his term of office, and he made many friends among electrical men, who regret that the Sanitary District will lose his services through the turn of the political wheel. The incident illustrates, however, the unsatisfactory nature of political control of industrial operations.

MR. LEONARD J. BOTTING has joined the Central Station Development Company, of Cleveland, Ohio, as secretary, and will have charge of the examination, auditing and appraisal work of that company. Mr. Botting was born in England in 1875, coming to this country when about fourteen years old. Prior to his identification with the electrical industry he was associated with financial interests and acquired an extensive knowledge of accounting and bookkeeping. He has had experience with central-station work for many years, and since 1901 has been connected with the Constantine Hydraulic Company, of Three Rivers, Mich., the entire plant of which, including the transmission lines to Three Rivers, White Pigeon and Cassopolis, was built by Mr. Botting. He served this company as secretary and general manager, and has also acted in the capacity of United States receiver for certain properties. He has also served several financial interests in the West by examining and reporting on hydroelectric and central-station propositions. Mr. Botting has always been an ardent advocate of modern business methods as applied to the central station, and the record of connected load and income per capita at Three Rivers ranks with the best in the country.

MR. LEONARD J. BOTTING.

MR. W. P. WALLACE, of New York City, has been appointed manager of the Maumee Valley Electric Company, of Toledo, Ohio, to take effect Nov. 1, with offices in the Meredith Building. Since May Mr. Wallace has been in entire charge of the construction of this company's properties along the Maumee River, including the erection of one of the most modern hydroelectric plants in the country and the installation and erection of the complete equipment for high-tension distribution lines to the surrounding cities and towns. Several extensions to the present system are now being contemplated.

MR. R. E. RICHARDSON, formerly connected with the Kansas City Electric Company, who it was erroneously announced would be connected with the Commonwealth Power Company, of Jackson, Mich., will instead become general manager of the Grand Rapids-Muskegon Power Company, at Grand Rapids, Mich.

MR. S. MORGAN BUSHNELL addressed the regular meeting of the members of the contract department of the Commonwealth Edison Company of Chicago on the evening of Nov. 7. The contract agents took dinner together at a restaurant, and after the transaction of some general business listened to Mr. Bushnell's illustrated account of his recent European trip.

MR. ERNEST F. SMITH, the recently elected chairman of the Commonwealth Edison branch of the National Electric Light Association in Chicago, is at the head of an organization of 485 practical electrical men. He thus occupies a position of no little responsibility, with a large opportunity for helpful work. Mr. Smith is the superintendent of substations of the Commonwealth Edison Company and has charge of 35 substations and 190 men. He was born near St. Charles, Ill., and as a young man came to Chicago to read law. He discovered, however, that legal studies were not to his taste, whereas he was very much interested in electricity. Accordingly he secured a position with the old Chicago Edison Company in the meter department seventeen years ago. He has been with the company and its successor ever since. He was the first substation operator of the company when a "distribution room" was established at the Adams Street headquarters at the time the Harrison Street generating station was built. Subsequently Mr. Smith was connected with the underground department in charge of the testing of underground feeders and mains. He then became general foreman of low-tension underground repairs and construction. Afterward he was connected with the statistical bureau, and he was next appointed one of the assistants of Mr. W. L. Abbott when that gentleman was made chief operating engineer. In 1904 Mr. Smith was appointed superintendent of substations, which position he has since held, acting also as a member of the important advisory committee of the Commonwealth Edison organization. His career exemplifies the growth of the central-station industry in Chicago and the possibilities which its development affords to a young man. Mr. Smith is a student and a member of a number of technical and semi-technical societies, before some of which he has read papers. He is married and has one daughter.

MR. ERNEST F. SMITH.

MR. WALTER FARADAY, whose portrait is given here, is not an electrical man, but as one of the two relatives of Michael Faraday in the United States he is a member of a family in which all persons engaged in electrical pursuits feel a peculiar interest. Michael Faraday, who died in London in 1867, left no direct descendants. He had a brother and two sisters, however, and Walter Faraday is a grandson of Robert, the brother, being thus a grand-nephew of the great Faraday. Walter Faraday is the son of Tertius Faraday, who was the son of Robert. He was born in Birmingham, England, in 1866, but has been a resident of this country since 1887. He was educated at King Edward's School, in Birmingham, and at Hampstead Hill College, near that city. His father, Tertius Faraday, was secretary of the London Coal Exchange for many years. On coming to this country Walter Faraday resided in Rockford, Ill., for a short time, and here he had his only experience with electrical work, being connected for a few months with an arc-lighting plant that was in existence in Rockford at that time. In 1889 Mr. Faraday removed to Chicago and engaged in journalistic pursuits. For a number of years he was connected with the City Press Association, and the fidelity of his court reporting won for him a large circle of friends among judges and lawyers. In 1900 he resigned from the City Press Association to engage in commercial business, and since then he has been connected with several surety companies in Chicago, being now one of the resident managers of a New York surety company. As Mr. Faraday was born just a year before his great-uncle died, he has no recollection of him. He is proud of his illustrious relative, however, and says that he and a cousin, Richard, in San Francisco, are the only members of the family resident in the United States. Mr. Walter Faraday is a member of the Chicago Press Club, the Ridgemoor Golf Club and other clubs, and has a wide acquaintance among the business men of Chicago. He is married and has two children, Benton and Lucy.

MR. WALTER FARADAY.

MR. HARRY B. RAMEY has been appointed assistant general manager of the Robbins & Myers Company, of Springfield, Ohio. Mr. Ramey is a graduate of the Washington High School, of Washington, D. C., and in 1892 was graduated from the National University Law School. He entered the government service as a special agent of the Interior Department and resigned Jan. 1, 1902, to connect himself with the late E. W. Gilmer's interests at Warren, Ohio. He represented the Warren Electric & Specialty Company for a time in Indiana and Michigan, and later on became a general representative of this company. At the time the Peerless Electric Company was organized he became associated with that company as general representative, and resigned Jan. 1, 1904, to become secretary and general manager of the Monarch Incandescent Lamp Company, with which he remained until January, 1905, when he accepted a position with the National Electric Lamp Company, of Cleveland, Ohio, as sales manager of the Economy Electric Company, with headquarters at Warren, Ohio. On Jan. 1, 1907, he resigned to accept the position of special representative with the Sterling Electrical Manufacturing Company, where he remained until April 1, 1908, when he became sales manager of the motor department of the Robbins & Myers Company. Mr. Ramey has been lieutenant-colonel of the Fifth Ohio Infantry since May 30, 1902.

Obituary.

MR. CHARLES A. YERGIN, manager and superintendent of the Public Service Operating Company, of Owatonna, Minn., was found dead behind the switchboard of his plant on Nov. 3. But a short time before this discovery Mr. Yergin had gone behind the board to work on the installation of a new regulator. One of the employees came in to get a tool and saw the superintendent busily engaged at his task. This man returned in less than three minutes and found Mr. Yergin stretched on the floor, lifeless. Evidently death was instantaneous. Two doctors were summoned quickly, but their long-continued efforts to restore animation were of no avail. It is believed that in some manner Mr. Yergin received a shock from the 2200-volt circuit at the back of the board. A burn was found on his head and another on the little finger of his right hand. Mr. Yergin was twenty-seven years of age and had been in charge of the plant about a year. He was highly regarded by the people of Owatonna. It is said that on the day of his death he remarked to a friend that there was danger attending the installation of the new regulator, and that some one might get hurt before the job was finished. That he himself should be the victim shows his devotion to his work and his regard for his fellow employees. The body was taken to Goshen, Ind., Mr. Yergin's former home, for burial.

Trade Publications.

CONVEYING MACHINERY.—In its Book No. 96, the Link-Belt Company, Philadelphia, gives numerous illustrations of conveying machinery, arranged with especial reference to its use in sugar refineries.

DIRECT-CURRENT MOTORS.—Steel-frame, direct-current motors, built in all standard sizes for 115 volts, 230 volts, or 500 volts, are described in Bulletin No. 391 of the Triumph Electric Company, Cincinnati, Ohio.

STORAGE BATTERIES.—Bulletin No. 125 of the Electric Storage Battery Company, Philadelphia, Pa., contains a complete description of the storage battery installations used by the Gulfport & Mississippi Coast Traction Company.

NATIONAL METAL MOLDING.—The National Metal Molding Company, Pittsburgh, has issued a new edition of its catalog of metal wiring moldings, which includes several new fittings. Among these are a combination outlet box, a combination twisted elbow and drop tee, and a continuous combination rosette and fixture outlet.

WATT-HOUR METERS.—Much information relating to the constructive details of induction-type watt-hour meters is given in Bulletin No. 1125, of the Ft. Wayne Electric Works, Ft. Wayne, Ind. Instruction Book No. 3043 contains numerous diagrams relating to the methods by which these watt-hour meters may be used in various circuits.

RECORDING THERMOMETERS.—Thermometers designed for recording temperatures between 90 deg. Fahr. and 500 deg. Fahr. are described in Bulletin No. 126 of the Bristol Company, Waterbury, Conn. Numerous illustrations are given of the various types of thermometer bulbs suitable for numerous industrial processes in which the recording thermometer may be employed.

SINGLE-PHASE MOTORS.—Bulletin No. 14, of the Century Electric Company, St. Louis, Mo., is an illustrated booklet giving much information relative to the constructive features and operating characteristics of single-phase motors. These motors are of the so-called repulsion-induction type, being provided with a commutator, by means of which the torque under starting conditions is kept at a satisfactorily high value.

AUTOMATIC ELECTRIC TRANSPORTATION.—The Automatic Transportation Company, 2933 Main Street, Buffalo, has issued a pamphlet describing its system of transportation, which comprises a series of concrete or metal posts, capped by malleable iron Y's, which support a double steel track of 30-inch gage elevated above the ground. The carriers or motor-cars travel automatically on these parallel rails at any desired rate of speed up to forty or fifty miles per hour.

COMPOSITE TELEPHONE AND TELEGRAPH SYSTEM FOR RAILWAY SERVICE.—The Western Electric Company has issued Booklet T-206 describing its composite telephone and telegraph system for railway service. This system has been devised for the purpose of enabling telephone and telegraph messages to be transmitted simultaneously over grounded telegraph lines. The booklet contains fifty-four pages and is illustrated by many cuts of telephone sets, howlers, coils, condensers, protectors, batteries, line poles and a dozen circuit diagrams.

WATT-HOUR METERS.—The Columbia Meter Company, Indianapolis, Ind., has just issued its revised price list to supplement its type D bulletin. These revised prices took effect November 1, but will not affect existing yearly contracts. The company has also prepared a new bulletin on the subject of its direct-current, rotating-standard test watt-hour meters for checking customers' meters, particularly those of current range between 5 and 20 amp. For this purpose extra wiring and contact plugs have been omitted, making the manipulation of the meter relatively simple.

CENTRAL-STATION ADVERTISING COPY.—The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., has just issued two "Ad Books," Nos. 20 and 21, offering newspaper copy to the central stations booming electrical appliances. No. 20 contains a complete collection of attractive and forceful "ads" covering the Westinghouse company's lines of toaster stoves, disk stoves, irons, luminous radiators, air heaters, bell-ringing transformers and Cooper Hewitt rectifiers. No. 21 contains comprehensive, forceful advertisements of the company's general utility motor. The copy is intended to be of assistance to central-station companies conducting campaigns to build up their day loads.

BUSINESS NOTES.

ROSSITER, MACGOVERN & COMPANY have moved their offices from 90 West Street, New York City, to Claremont and Mallory Avenues, Jersey City, N. J.

CONNECTICUT STEERING WHEEL SWITCH.—Grant, in an Alco, won the Vanderbilt Cup in 1909 and 1910, using a Connecticut steering wheel switch. This little switch on the steering wheel put the absolute control of the car under his thumb without removing his hand from the steering wheel, and permitted him to take the turns and curves with perfect safety.

THE ELLIOTT COMPANY, of Pittsburgh, Pa., has recently acquired the entire business, patents and good will of the Pittsburgh Feed Water Heater Company, Pittsburgh, Pa., and will in the future be the sole manufacturers of the well-known Pittsburgh Feed Water Heater, including the three types, namely, the vertical, horizontal and closed, and will be able to supply heaters in units from 100 hp up to and including 30,000 hp.

PAWLING & HARNISCHFEGER COMPANY.—Owing to the increase of its business in the Pacific Coast territory the Pawling & Harnischfeger Company, Milwaukee, Wis., manufacturer of cranes, hoists and lumber-handling apparatus, has established a branch office in the Washington Building, Portland, Ore. This office will be in charge of Mr. R. K. Morse, for a number of years a member of the engineering staff at the Milwaukee office of the company.

ILLUMINATING ENGINEERING SERVICE.—The Holophane Company is giving much study to the subject of industrial lighting in all its phases and maintains a special bureau, directed by Mr. E. E. Scribner, which is devoted exclusively to this branch of illuminating engineering. As in other departments of lighting, the company offers the services of its industrial engineers without charge to central stations, contracting engineers or consumers who may desire their co-operation in solving mill or factory lighting problems.

WAVERLEY CHICAGO BRANCH.—The gratifying success of the Waverley Electric Vehicle Agency in Chicago has led to the opening of a Chicago branch of the Waverley company temporarily at 1714 Michigan Avenue, but soon to be moved to new and handsome quarters farther south on the same street. Mr. J. C. Cooley, who is in charge of the new branch as manager, has been identified with the Waverley Electric Vehicle Agency since its inception. Mr. Cooley will be assisted by Mr. W. H. Corris, whose experience in the electric vehicle business and personal acquaintance in Chicago will be of much value to the new branch. In addition, there will be an adequate force of salesmen and demonstrators together with as many technical men from the home factory as may be required.

THE MILLAR ELECTRIC COMPANY has been incorporated to carry on an electric heating business, locating at 222-224 South Canal Street, Chicago, where the main office and factory are established. The company is preparing for the Christmas trade an attractive and efficient electric toaster, which it will have all ready for distribution about Dec. 1. The toaster itself is stated to be a radical departure in its field, and it is claimed that its simplicity, general attractiveness and efficiency will recommend it to all toast lovers. After Dec. 1 the company will bring out its other heating appliances, which will include practically a full line. The company will confine itself strictly to a wholesale business, distributing its product only through jobbers and department stores. The officers of the company are: R. M. Millar, president, and Francis Granger, treasurer and general manager.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 7, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

974,789. OZONIZER; D. S. Henney, Newark, N. J. App. filed Aug. 1, 1910. For producing ozone from the atmosphere by means of two open glass cylinders spaced apart and concentric and each having a layer of foil with an electrode within the inner vessel.

974,800. SIGNALING SYSTEM FOR RAILWAYS; J. A. Jones, Ward, W. Va. App. filed Nov. 9, 1908. For automatically ringing an alarm by current generated in the moving train while the train is in the block by means of track sections with signals consisting of dials and pointers constituting a recording mechanism in the cab and bell alarms which are operated by a car-carried generator.

974,812. PROCESS OF MAKING INCANDESCENT ELECTRIC LAMP FILAMENTS; H. C. Parker, New York, N. Y. App. filed Apr. 10, 1909. Flashes the filament in atmosphere containing hydrogen, oxychlorid of chromium and olefiant gas.

974,838. RECEIVING APPARATUS FOR ELECTROMAGNETIC WAVES; E. H. Smythe, Chicago, Ill. App. filed July 24, 1906. An electrolyte with a cathode and an anode having a very small area and a relatively large area, respectively exposed to the electrolyte and a cathode consisting of a minute wire.

974,838.—Receiver.

974,859. LIGHTNING ARRESTER; W. Butler, Lockport, N. Y. App. filed June 13, 1908. A pole with a horn-type arrester, a magnet, a governing armature with a wire connecting the horn arrester with the magnet, a switch box, a shaft in the box, an insulator disk on the shaft between contacts and carrying a pair of conductors contacting therewith and a motor for driving the shaft.

974,864. RAILWAY SIGNAL; F. L. Dodgson, Rochester, N. Y. App. filed Apr. 23, 1904. Two-blade signal mechanism operated by an electric motor with an electric clutch for each blade consisting of a solenoid magnet which operates a pin to clutch the blade shaft to the signal rod.

974,866. AUTOMATIC TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Aug. 3, 1907. Automatic telephone in which direct selective switches complete the connections by linking local trunk circuits at the exchange with improvements in operating the selective switches.

974,891. METHOD OF MAKING METALLIC FABRIC; M. & L. S. Lachman, New York, N. Y. App. filed Mar. 11, 1909. Forms a projection on a strip, places a member in contact therewith and passes a current through the strip of the member to raise the temperature at the point of contact to a welding heat and then applies pressure.

974,892. METHOD OF MAKING METALLIC FABRIC; M. and L. S. Lachman, New York, N. Y. App. filed Mar. 11, 1909. Forms projections on flat strips, passes a current through them at the point of intersection, the resistance to the passage of the current heating the metal to a welding heat and then applies pressure.

974,920. TROLLEY CATCHER; J. R. Ricketts, Longbeach, Cal. App. filed Sept. 15, 1909. Includes a reel for the trolley rope with a plurality of dogs sliding on the reel and stopped by a stop when the reel moves faster than the dog. A lever projects through the reel casing and is pressed by a spring. The rope is wound around the reel.

974,927. RECEIVING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed Dec. 11, 1906. For wireless, including a wave receiver of normal sensitiveness with means for reproducing a signal and a local producer of high frequency waves for rendering the receiver over-sensitive. The wave receiver is an electrochemical cell.

974,943. ILLUMINATED ANNOUNCEMENT AND DISPLAY SIGNAL; F. W. Wood, Newport News, Va. App. filed June 17, 1908. For producing any numeral by means of elongated lamp cells forming a pair of rectangular frames with a diagonal across one of them, together with rotary drums and guards carrying character-defining positions, which drums act as transmitters.

974,946. INCANDESCENT LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Mar. 4, 1907. A plug lamp socket in which the lamp enters the socket at right angles to the vertical axis of the socket so as to increase the illumination. Details.

974,947. ELECTRIC LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Apr. 11, 1907. A double lamp socket in which each lamp enters the socket at right angles to the vertical axis of the socket or plug to increase the illumination. Details.

974,955. AUTOMATIC TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Nov. 23, 1907. Employs a plurality of selecting switches, including a first selector, a second selector, connector switches and line selectors, the line selectors being connected to a first selector and then temporarily associating the first selector with the calling line by means of automatically controlled apparatus.

974,982. CATENARY OVERHEAD SYSTEM FOR ELECTRIC RAILWAYS; W. A. McCallum, Cincinnati, O. App. filed May 13, 1909. The suspending element is a cable in a vertical plane arranged zigzag between the messenger wire and the trolley, being attached thereto by hooks and eyes.

974,985. RECEIVING APPARATUS; F. W. Midgley, Jersey City, N. J. App. filed Feb. 25, 1909. A looped aerial with capacity and inductance in the loop forming a closed circuit, the loop being grounded through either the inductance or condenser and a circuit in inductive relation to the loop, including a wave receiver.

974,986. RECEIVING APPARATUS; F. W. Midgley, Jersey City, N. J. App. filed March 5, 1906. A condenser, the wave responsive device (preferably a primary cell detector) and another condenser are in shunt to the main condenser and the terminals of the circuit are connected to an inductance in the receiving aerial.

975,032. JUNCTION BOX; E. T. Greenfield, Kiamesha, N. Y. App. filed Jan. 16, 1909. Makes use of a screw for securing the conductors in the box, the screw being tapered and extending through a threaded opening so that the side of the screw wedges against the conductor.

975,034. ARC LAMP; P. Hanisch, Cologne-on-the-Rhine, Germany. App. filed Sept. 15, 1908. The electrodes are inclined toward each other downwardly and cross above their lower ends, and automatic means permits movement of one of the electrodes to increase the feed with increased current strength.

975,040. PROCESS FOR REMOVING OXYGEN FROM VESSELS; R. Hopfelt, Cologne-Klettenberg, Germany. App. filed July 14, 1910. For removing oxygen from lamp bulbs by first evacuating them and then mixing in phosphorous-halogen gases with hydrogen to ignite.

975,073. ELECTRICAL HAIR-SINGEING DEVICE; E. A. Roberts and N. L. Johnson, Buhl, Minn. App. filed Jan. 20, 1910. A handle member with a removable head carrying tubes receiving contacts in a cap which connect an electric circuit and heat a wire loop.

975,090. ELECTRICAL COUPLING AND SWITCH; R. H. Wappler, New York, N. Y. App. filed May 25, 1910. An electric coupling and switch for electro-medical use, including a spring finger contacting electrically with the parts so that there is a sliding contact with rotation of the parts between the spring finger and the contacts.

975,105. SEMI-AUTOMATIC TELEPHONE SYSTEM; C. R. Austin, Longbeach, Cal. App. filed April 30, 1907. Central is connected to substations and an automatic subcentral station is provided doing away with an operator, the call being accomplished by removing the receiver from the hook, the call being automatically trunked to one central, where it is manually connected to the trunk leading to the subcentral station, where the trunk is automatically connected to the subscriber's line.

975,107. ELECTRIC BAKING OVEN; J. I. Ayer, Cambridge, and H. B. Gale, Natick, Mass. App. filed Nov. 11, 1909. Contains a plurality of cells with a heating chamber below the baking chamber and heating elements consisting of conducting plates set vertically edgewise with cold-air and hot-air flues.

975,118. ELECTRICAL CONNECTOR; J. J. Burns, Worcester, Mass. App. filed Nov. 23, 1908. Particularly for the high-tension terminal of a spark coil in which the strands of the conductor can be spread out and clamped to a metal plug and a spring-pressed contactor projects inside of the receptacle for engagement with a contact surface therein.

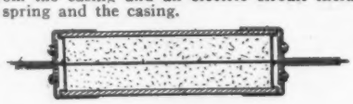
975,126. NERNST LAMP BODY; O. Foell & M. Harris, Pittsburgh, Pa. App. filed Nov. 11, 1908. An insulating base with terminals and a ballast terminal and strip with ballast tube secured to the strip and a cut-out on the base portion and connected to the strip.

975,149. AUTOMATIC GAS FEED FOR VACUUM TUBES; D. McF. Moore, Newark, N. J. App. filed Nov. 8, 1906. Two diaphragms are used for aneroid manometers, one having a constant vacuum and the other varying with the tension of the gas. The diaphragms control a circuit including a magnet which operates a valve.

975,165. FLAMING ARC LAMP; R. Scott, Newark N. J. App. filed June 21, 1907. The electrodes project and converge downwardly and pass through a cup to which iron cheeks are connected forming consequent poles to keep the arc in a definite position.

975,175. ALARM SYSTEM; W. J. St. Onge, Elyria, Ohio. App. filed July 5, 1910. For fire alarm in which the key is confined behind a glass plate which must be crushed before the key can be removed, this operation closing the circuit.

975,186. BURGLAR ALARM SASH LOCK; M. Wheeler, Chicago, Ill. App. filed April 26, 1909. A metallic casing on the window frame with a key shaft in the casing, a cam on the shaft and a contact spring insulated from the casing and an electric circuit including an alarm, the contact spring and the casing.



975,261.—Safety Fuse.

975,261. SAFETY FUSE; S. J. Leveen and E. A. Martin, Rock Island, Ill. App. filed Dec. 4, 1907. A case with a continuous fuse strip extending through the case and self-adjusting contact plates to receive the ends of the strip.

975,302. TROLLEY; J. Tari, East Columbus, Ohio. App. filed Aug. 14, 1909. A trolley with a pivoted end portion carrying a pivoted upright on which two trolley wheels are mounted as well as guards for the wire operated by the rope.

975,338. TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Dec. 4, 1906. Automatic and semi-automatic type in which electrically controlled switches operate when the party's receiver is taken from the hook to establish connection between the calling subscriber and any line; the subscribers' lines being divided into groups and a small number of connected switches being assigned to each group under the control of a master switch which upon the initiation of call starts an idle connecting switch to establish a connection with the calling line.

975,346. TELEPHONE DISINFECTOR; B. F. Gardner, Chicago, Ill. App. filed Aug. 29, 1910. Makes use of the destructive discharge of an induction coil whose terminals are arranged within the mouthpiece of the telephone transmitter.

975,358. ELECTRICAL HEATER AND MANNER OF MANUFACTURING SAME IN THE FORM OF TEXTILES; M. Hefter, St. Petersburg, Russia. App. filed Feb. 1, 1910. A nickel wire takes the place of some of the threads of the warp and is periodically brought into the surface of the fabric, the warp threads being nonconducting.

975,359. KNITTED ELECTRIC HEATING BODY; M. Hefter, St. Petersburg, Russia. App. filed Feb. 1, 1910. The fabric contains an insulated electric conductor which is knitted into successive transverse sections of the fabric, the sections being separated by other sections not including the conductor.

975,386. METHOD OF PRODUCING METALLIC ARTICLES BY ELECTRODEPOSITION; F. I. Gibbs, Birmingham, England. App. filed Feb. 23, 1909. For electro depositing on pottery wear by forming a rounded rim at an opening in a metal article and continuing it so that when the metal is electrodeposited a rim will be formed around the top of the vessel from which the model can be removed and the rim filled in and made solid.